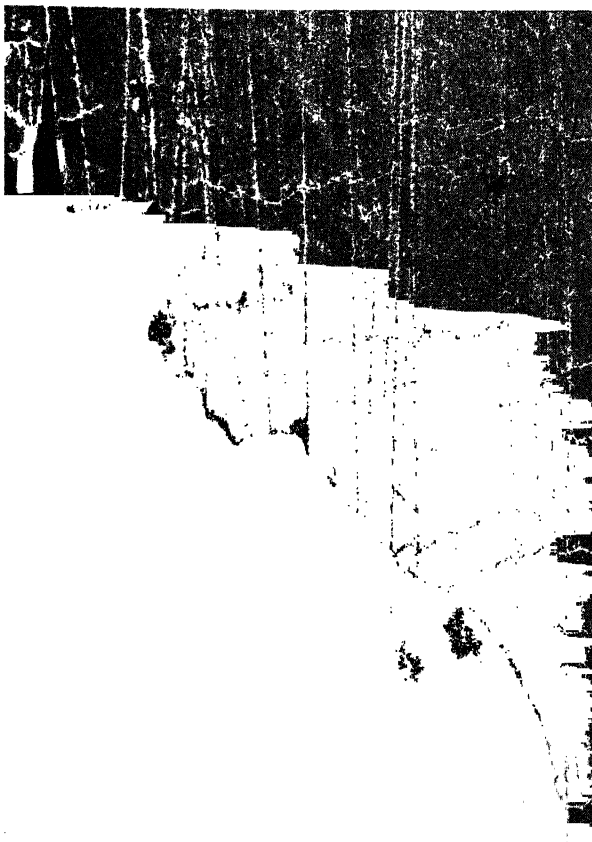


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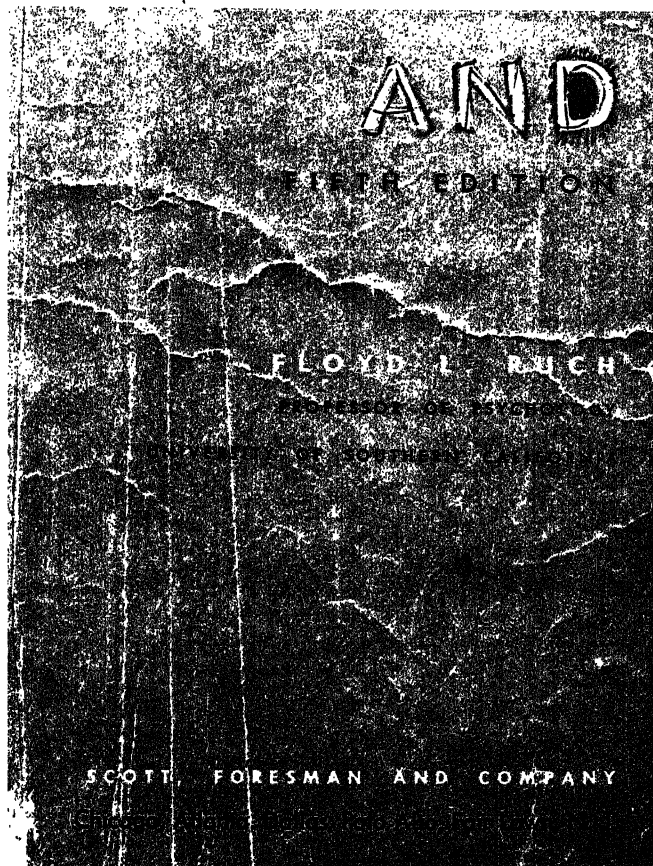
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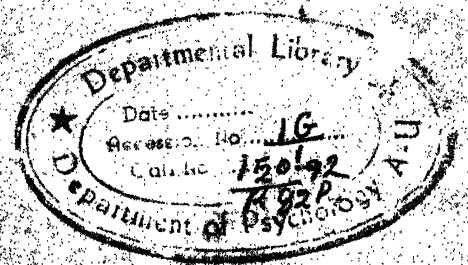
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PSYCHOLOGY



LIFE



AN IDEA COMES OF AGE

Just twenty-one years ago the first edition of *Psychology and Life* appeared. It was based on a simple idea—that psychology, of all subjects, should be stimulating and illuminating to students and that a text for beginning students should go beyond the conventional grounding in scientific psychology to show how psychology is related to life. It was the author's conviction that this further responsibility could be met without loss of scientific rigor—that, on the contrary, the conventional aims of the general course would actually be better served in this way.

At the time this was a revolutionary idea, and considerable skepticism was expressed. But the idea took hold and today represents a common approach for beginning texts. Not only has it proved possible to present scientific psychology in an interesting, life-related way, but experience has shown such an approach to be highly challenging and effective whether students go on to further courses in psychology or have only this one formal encounter with the science.

DEVELOPMENT OF THE PSYCHOLOGY AND LIFE PROGRAM

Each edition of *Psychology and Life* has held to the original objective. But with successive revisions there has been a broadening of scope, a further pointing up of the basic concepts and principles of psychology, better integration of the various parts, fuller implementation of important ideas through illustration and format, and a continuing effort to achieve greater clarity and directness of writing style. Each edition has incorporated more laboratory findings, more clinical findings, more reports of research in social and applied fields, and more related information from anthropology, sociology, and biology as it has become increasingly apparent that a complete science of behavior must include all these

approaches. At the same time new dimensions have been added to the course through the several elements in the workbook and through the many suggestions given in the teacher's manual.

In every edition diverse talents have been drawn upon. Some of the most constructive help has come from colleagues whose academic orientations were at variance with the point of view of *Psychology and Life* and whose convictions about the first course were quite different from those of the author. Their numerous and penetrating suggestions have vastly enriched *Psychology and Life* over the years.

THE FIFTH EDITION—

A FURTHER INTEGRATED PROGRAM

The Fifth Edition is a continuation and a consolidation of all that has gone before, with further broadening, updating, and integrating of the findings reported and with greater flexibility made possible by division of the material into twenty chapters. It has been substantially rewritten and entirely reset. The new edition includes more clinical material, more studies of group behavior and dynamics, more findings on mass communication, follow-ups of several clinical cases reported in earlier editions, and a glossary which, for each term, gives both a definition and a reference to the page in the text where the term is most fully explained in context.

The most significant innovation of this new edition is the inclusion of a new section, "Frontiers in Psychology," consisting of articles written especially for *Psychology and Life* by ten well-known psychologists and sociologists, summarizing the current research and thinking in their several areas of specialization. Through these "Frontiers" students in the beginning course will for the first time have a chance to visit the outposts of today's knowl-

edge and glimpse what may lie ahead. The author is deeply grateful to these colleagues for their willingness to put into short, non-technical articles for beginning students ideas and concepts often reserved for graduate-level work.

One of the important objectives of the first course is an understanding and appreciation of scientific method. Yet it is hard for students to gain a real understanding of experimental procedures or an ability to evaluate research critically in the absence of actual laboratory experience. A further basic feature in the new *Psychology and Life* Program has been designed especially to help resolve this dilemma. In the workbook, in addition to the former experiments to be done in class, there are "Studies of Experimental Method"—one for each chapter. These give brief summaries of published studies, describe the purpose of each experiment and the controls used, and report the data that were obtained. Students are then guided in interpreting the tables and graphs and in evaluating the research design and the experimenter's conclusions. In this way students can see for themselves the special difficulties that confront the psychological experimenter and the different methods by which different kinds of problems may be investigated.

In addition to the redeveloped text, then, the 1958 *Psychology and Life* Program includes a revised workbook, *Working with Psychology*, Fifth Edition; a broadened teacher's manual, *Instructor's Notebook for the Psychology and Life Program*; and *Libraries of Test Items*, available without charge to all instructors using the text.

THE INSTRUCTOR'S NOTEBOOK—

A TOOL OF MANY USES

A number of quite different courses may now be built around *Psychology and Life* by assigning different selections and sequences of chapters in the text and different elements in the workbook and by using various additional readings, films, demonstrations, field trips, and other projects. In the *Instructor's Notebook* some alternate courses are spelled out, and chapter-by-chapter suggestions are made for supplementary activities of various kinds so that each instructor can select the combination, sequence, and emphasis that best meet his needs.

ACKNOWLEDGMENT IS DUE...

This Fifth Edition has been developed from experience gained in the creation of the preceding four editions. The earlier editions owed much of their effectiveness to the consultation and contributions of the following critical readers and collaborators, to whom the author wishes again to acknowledge his indebtedness. Edition of 1937: R. M. Elliott, whose seminars at Columbia University in 1929 inspired the author to write a student-oriented textbook; E. R. Hilgard, for constructive criticism of the manuscript; G. M. Ruch, for critical reading of galley proofs. Edition of 1941: D. G. Marquis, for critical reading of the entire manuscript; T. C. Ruch, for editing the chapter on the brain and nervous system. Edition of 1948: Arthur G. Bills, Constance Lovell, Ann Margaret, Robert H. Seashore, Charles L. Stone, and G. R. Wendt, for critical reading and creative comments on the previous edition; Robert Leeper, for writing materials on learning; T. C. Ruch, for authoring the Reference Manual on the brain and nervous system; Joseph Shoben, for preparing material on clinical studies of emotional development. Edition of 1953: Claude E. Buxton and Carl P. Duncan, for provocative criticism of the manuscript; James S. Ford, for assistance in library research; Herman Harvey for an evaluative summary of the work of Hans Selye; T. C. Ruch, for revision of the section on the brain and nervous system.

The critical readers who gave special assistance in the preparation of the Fifth Edition of *Psychology and Life* are listed facing the title page, and the author is greatly indebted to them, individually and collectively, for patient and constructive presentation of their points of view. Thanks are due also to Mrs. Letha Curtis Musgrave, M.A., whose conscientious and competent services in developing bibliographies, checking references, typing and copy reading over a two-year period have sufficiently reduced the labors of the author to permit the new edition to appear as scheduled. And finally my thanks must go to the hundreds of users who, directly and indirectly, have given us the benefit of their experience with *Psychology and Life* in the classroom.

May the resulting new edition help prepare those who come to it for the opportunities and challenges of their time.

F. L. R.

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THE PROPER STUDY OF MANKIND IS MAN

ALEXANDER POPE

PART ONE FOUNDATION

The first thing you need to know as you begin the study of psychology is just what psychology is—and what it is not. And so, in Chapter 1, you will find out what psychologists today regard as their subject matter and how the definition of the science, its emphases, and its methods of study have changed. You will see that a number of special techniques have been devised for gathering and interpreting psychological data and that different kinds of problems must often be studied by quite different methods. Throughout the book there will be examples of the use of these different methods. The chapters on emotional problems, for instance, will draw heavily on clinical findings; the chapters on perception and learning will report many laboratory experiments; and the chapters on group problems will describe the use of still other techniques that have helped unlock the secrets of how and why people behave as they do.

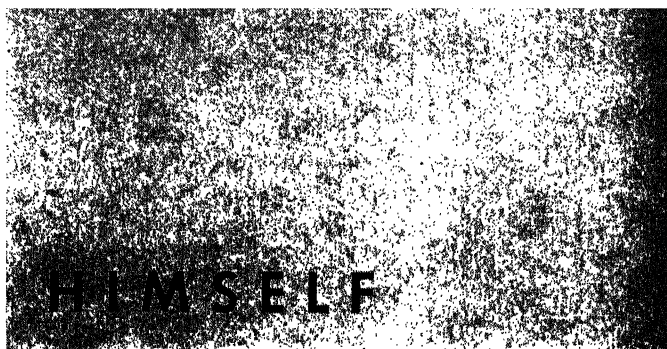
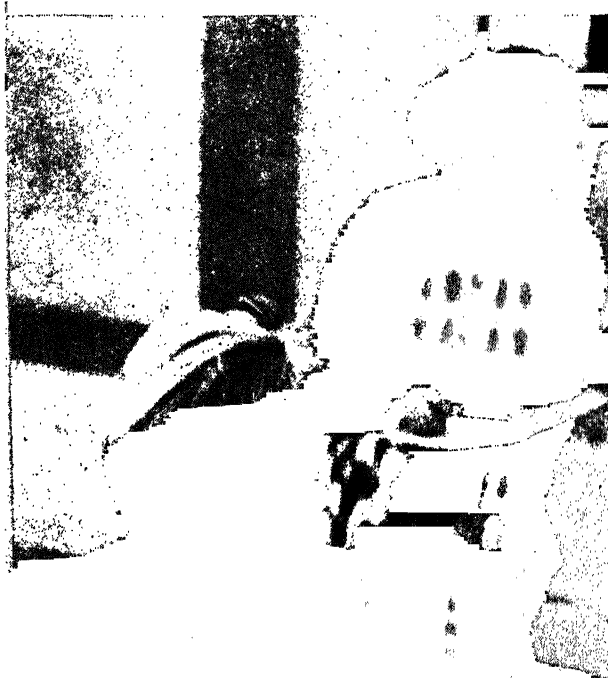
The remaining chapters of Part One are also "foundation" chapters in that they explain concepts you will need for understanding the later parts of the text. Chapter 2 investigates the basic ingredients with which all human beings begin their lives. You will see how heredity and environment interact in human development from the moment of conception and will find that both physical and psychological development tend to follow a predictable sequence.

In Chapters 3 and 4 you will examine the ways in which psychologists have tried to define and measure personality characteristics, and you will discover how far the different kinds of measuring instruments they have developed can be trusted. Chapter 3 also touches on some of the basic statistical concepts necessary for an understanding of how experiments are designed and how findings are interpreted.

In this book we will be reporting the main discoveries to date in the various areas of a still very "unfinished" science. One of the things that will undoubtedly impress you before you get very far is how much we still do not know. Psychology is such a new science that many of the important problems with which it is concerned have not yet even been investigated; and sometimes the findings which have been made are not well integrated with each other because they have been obtained by different groups of people working in different settings on different kinds of problems, often without any knowledge of each other's activities. So as you read about the work of clinicians, laboratory psychologists, industrial psychologists, and others, keep looking for the ways in which their concepts and findings corroborate, supplement, or, in some cases, contradict each other. The building of a new science is a slow process in which partial understandings are constantly refined and broadened as new evidence is obtained, and in which conclusions are always tentative, pending the discovery of further information. Therein lie the fascination and the great challenge.

CHAPTER ONE

MAN STUDIES HIMSELF



THE HERITAGE OF MODERN PSYCHOLOGY

WHAT IS PSYCHOLOGY?

SCIENTIFIC TECHNIQUES OF MODERN
PSYCHOLOGY

The breath-taking progress of physical science during the past half century has made it clear that, in order to survive, all men must learn to understand and cooperate with other peoples. It is hardly surprising, therefore, that during the past two decades society has turned more and more to the psychologist and other social scientists for help in understanding and predicting human behavior.

This interest in explaining and controlling human behavior, however, is not a new development. In every culture and from the earliest times, man has examined himself earnestly in search of explanations for his feelings, experiences, and behavior. He has looked for answers in superstition, religion, philosophy, and finally in the scientific investigations of modern psychology. Because the question, "What am I?" is so important to man's curiosity and sense of security that almost any answer seems better than none, he has often been satisfied with answers that today seem absurd. There is security and comfort in being able to say, however unwisely, "I understand myself—and you too!" Even today, when psychology and the other sciences are furnishing man with more and more information about himself, many people still cling to superstitions and "common sense" notions that are demonstrably false, because they provide easy explanations for the complexities of human experience. While psychology is still a long way from being able to provide all the answers, one of its major contributions has been to substitute investigation and "honest doubt" for some of the ready-made answers of the past. }

THE HERITAGE OF MODERN PSYCHOLOGY

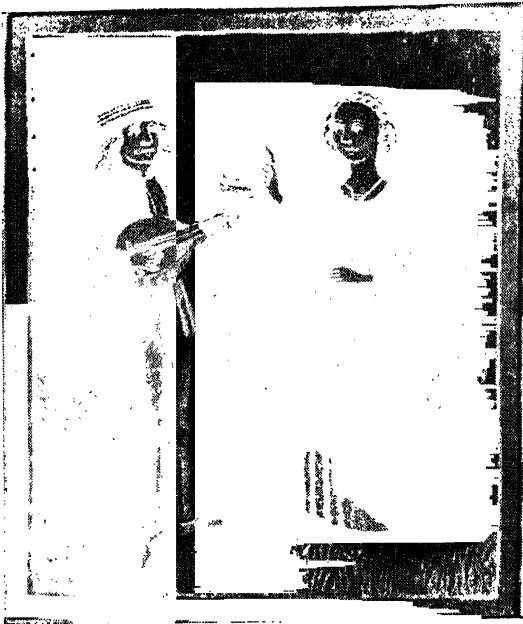
The modern science of psychology has both fought against and built upon man's earlier attempts to explain himself. While combating false notions from the past, scientific psychology continues man's long search for knowledge about himself and his universe. To understand the bases of modern psychology, it is important to consider some of the steps toward its development into a recognized science. }

CHARACTEROLOGY

In attempting to explain human traits and behavior, men through the ages have developed many pseudoscientific theories of "psychology." Most of these systems have used impressive technical language and formulas. Although this has led many people to believe that these systems must be scientifically sound, actually they are based upon casual observation and guesswork. These various pseudoscientific schemes for explaining human nature are referred to as *characterology*. Be-

cause so many untrue and confusing notions of personality still persist, especially among people lacking scientific background, it is worth while to examine some of these characterological systems briefly and consider their weaknesses from the viewpoint of modern psychology. }

The humoral theory. The oldest known characterological theory dates back to about 400 B.C. and was developed by the Greek physician Hippocrates, the "father of medicine." Just as the Greeks believed that all *physical* nature was composed of four elements (earth, air, fire, and water), so Hippocrates maintained that *human* nature could be ascribed to the four "humors" or fluids of the body, which he identified as blood, black bile, yellow bile, and phlegm. According to this theory, each humor was identifiable with a corresponding temperament. A person with a predominance of "black bile," for example, would tend to be disturbingly quiet, calm, sad, and brooding, whereas one with a predomi-



These illustrations of the humoral theory, which were taken from a medieval manuscript, show (from left to right) the sanguine, phlegmatic, melancholy, and choleric temperaments. The sanguine person, who had a predominance of "blood," was supposed to love "mirth and musick, wine and women," whereas the phlegmatic man preferred "rest and sloth." "A heavy looke, a spirit little daring" characterized the melancholy

nance of yellow bile would tend to be excitable, irascible, and aggressive. (See the above illustration.)

Although Hippocrates' classification of humors is unacceptable in the light of modern physiology, it enjoyed considerable popularity until as late as the seventeenth century. From a modern viewpoint, it is interesting to note that his fundamental principle of the dependence of temperament (as we now use the term) upon physiological functions is still maintained by psychologists. In fact, science today recognizes certain chemical substances, such as hormones, which are known to have some important influences on personality.

Phrenology. During the nineteenth century the doctrine of *phrenology* came into wide popularity and for a time was regarded as a legitimate science. The phrenologists claimed that personality was composed of a specific number of "faculties," and they assigned to each of these faculties a throne in some specific area of the brain. They argued that the person who possessed a great deal of a particular faculty would have a bump on his skull at the point where the "organ" for this power was supposed to be located and that an in-

dividual's personality could therefore be determined by studying the shape of his head. The seat of "amativeness," for instance, was supposed to be at the base of the skull, and persons who possessed large bumps at that point were described as "alive to the charms of the other sex, polite, affable, and free in their company, successful in gaining their confidence, and courageous in their defense" (Olin, 1914).

Modern objections to the claims of phrenology are overwhelming. A comparison of a phrenologist's map of the brain with the actual findings of neurologists, as illustrated on page 8, shows that there is no correspondence either in the location or in the function of the brain areas represented. (It is interesting to note that when we stimulate the part of the brain thought by phrenologists to be the center of religiousness, the subject twitches his leg.) Modern research has found nothing to support the existence of "faculties" as they were conceived by the phrenologists, but rather has shown that apparently the only type of brain localization to exist is that of general types of function—motor, visual, auditory, tactile, and so on.



type. And the choleric individual was identified as being "all violent, fierce and full of fire." Since the humors also corresponded to the elements, the various temperaments were supposedly related to a surplus of a particular element. Thus an individual with a sanguine temperament would have an over-abundance of air; the phlegmatic, of water; the melancholy, of earth; and the choleric, of fire.

Body-type theories. In spite of its long record of defeats, the belief that physical characteristics and psychological characteristics are related has persisted to the present time. Modern characterological conceptions, known as *body-type* theories, have tried to be somewhat more scientific in their approach, but in general have turned out to be about as erroneous as their predecessors. Rather than attempting to relate specific physical attributes to specific psychological characteristics, body-type theories are concerned more generally with relating the individual's overall build, or *morphology*, to his total personality structure.

Body type and psychotic temperament. A body-type theory which has stimulated extensive investigation in the field of abnormal psychology was proposed by Ernst Kretschmer, a German psychiatrist (Kretschmer, 1925). He noticed that mental patients with one set of symptoms seemed to differ markedly in physique from patients with a different set of symptoms. On the basis of his observations Kretschmer suggested that there were two main types of body structure, each associated with a characteristic temperament pattern. His two principal body types were the *pyknic*

(short and plump) and *leptosome* (tall and thin). Pyknic persons were supposed to have a temperament pattern which Kretschmer called *cyclothymic*. A cyclothymic person might be jolly, genial, and good-natured at times but would tend to fluctuate between gay and depressed moods. Leptosomes, on the other hand, were associated with the *schizothymic* temperament, which was characterized by sensitivity, eccentricity, and reserve. Although an individual's body type did not determine whether he would *become* psychotic, Kretschmer believed that it *did* influence the kind of disorder to which a given individual would be most disposed should he become mentally ill.

Final scientific judgment on Kretschmer's theory has yet to be made. Although the experience of psychiatrists and clinical psychologists upholds Kretschmer's observations to a slight extent, many conspicuous exceptions have been noted. The large number of uncontrolled factors in such observations—such as age and environmental influences—make it difficult to draw reliable conclusions. An outgrowth of the Kretschmer theory has been more adequately tested and found to lack validity, as we shall see below.

Sheldon's somatotype theory. The most recent body-type theory to attract widespread interest and popular curiosity is the *somatotype theory* proposed by W. H. Sheldon (Sheldon, 1940). There are, according to Sheldon's classification, three basic body types ("somatotypes"), each of which can be identified with a corresponding personality type, as summarized in the table on page 9 (based on Child, 1950).

Sheldon's claims have touched off considerable controversy in scientific circles and have stimulated active research to determine whether the relationships proposed by his theory actually exist. The experimental difficulties involved in testing Sheldon's theory, like other body-type systems, are complex, and the evidence is not entirely conclusive.

In one study fifty-one college sophomores of various somatotypes were subjected to heat stimuli and electric shocks to determine whether (as Sheldon maintains) mesomorphs can withstand pain more easily than ectomorphs. The results indicated that "of the relationships which might be predicted from Sheldon's published accounts of physique and temperament, none were found to be . . . significant" (Janoff, Beck, and Child, 1950).

Other studies have similarly failed to demonstrate any substantial relationships between somatotypes and such traits as esthetic values, social intelligence, masculinity, and submissiveness. It has even been

shown that although plump persons (endomorphs) may tend to eat more than thin persons, they do not demonstrate any greater fondness for food (Child and Sheldon, 1941; Smith, 1949).

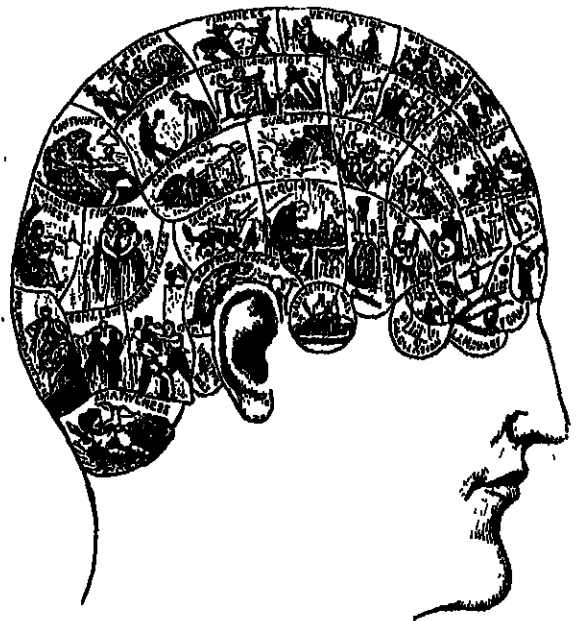
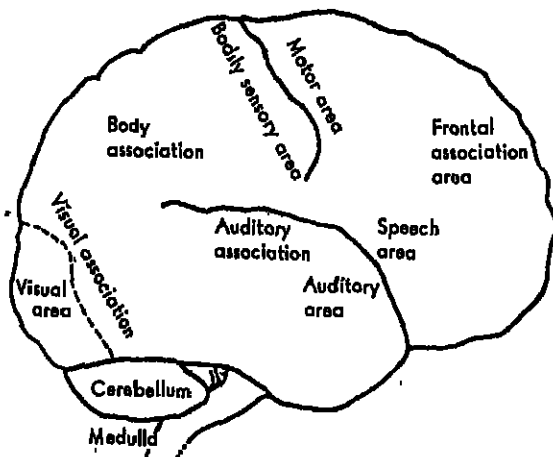
Sheldon's system, a numerical scale of body-typing, is an excellent method of describing an individual's physical appearance and as such has valuable application in police work where exact descriptions are desired for identifying criminals and missing persons. It seems to be without practical value, however, for such purposes as personnel selection, vocational guidance, or clinical treatment.

THE MIND-BODY PROBLEM

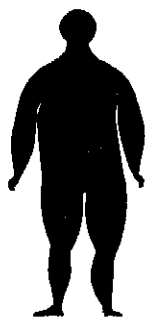
Until the nineteenth century, inquiry and speculation about the nature of the human mind were largely the province of philosophy. Some philosophers denied the existence of the mind completely, while others maintained that mind was the only reality. René Descartes, a seventeenth-century thinker, maintained that mind and body were entirely separate but that they interacted with one another. He proposed the pineal gland as the site of this interaction.

Although the activities of these philosophers were purely speculative, they were related to modern psychology in being motivated by a desire to understand the human mind and experience. Viewed from this standpoint, phi-

Science vs. Phrenology



Sheldon's Classification of Body Types



Body type	ENDOMORPHY (tendency toward roundness and softness throughout the body)	MESOMORPHY (predominance of muscle and bone)	ECTOMORPHY (fragility and "linearity" in body build)
Personality type	VISCERATONIA	SOMATOTONIA	CEREBROTONIA
Typical traits	Fond of food, inclined to eat too much, apprehensive, insecure, worried, amiable, sleeps well, conforms to social conventions.	Adventurous, likes strenuous exercise, takes cold showers, dresses informally, withstands pain easily and willingly.	Asocial, unamiable, dislikes nude swimming, lacks desire for exercise, does not withstand pain easily, nonadventurous.

Based on Sheldon, 1940, and Child, 1930

losophy still serves to complement psychology. Beginning around the end of the eighteenth century, however, the significance of the philosophic approach to the mind-body problem began to decline as more scientific evidence began appearing from the field of medicine and the rapidly growing science of physiology. Attempts to interpret these new findings in terms of the mind-body problem led to the establishment of psychology as a science.

Mesmerism. In the year 1778 an interesting individual by the name of Franz Mesmer set up offices in Paris to practice a new kind of healing known as *mesmerism*. Mesmer taught that there is a magnetic fluid flowing through all the universe, including the human body, and that illness results from an imbalance of the magnetic fluid within the body. A sick person was supposed to be cured by having a "magnetizer" (such as Mesmer himself) make the magnetic fluid flow in or out of him to restore the necessary balance. By passing steel magnets and rods over the bodies of his patients, who complained of a variety of symptoms, Mesmer was frequently able to relieve their symptoms and sometimes effected outright "cures." This technique has been called "animal magnetism." In the light of present knowledge it seems likely that the symptoms

of Mesmer's patients must have been largely psychological in origin and that they were cured by suggestion.

Mesmer was bitterly attacked by some medical men and hotly defended by others. He was finally repudiated by the French Academy of Sciences on the grounds that his cure could not be useful since it depended upon the imagination. It is now apparent that Mesmer had made a great discovery—although he misinterpreted it—and that the French Academy was wrong in concluding that the cure was not real because it was a product of the "imagination." Modern medicine is recognizing increasingly the close relationship between an individual's mental state and physical health, as evidenced by the new but growing field of psychosomatic medicine (page 154), devoted to the study and treatment of physical diseases that are caused or aggravated by emotional disturbances. Mesmer's work also led, more directly, to the development of hypnosis (page 226), which in turn was eventually to have considerable influence upon Freud's postulation of the "unconscious."

Mental illness. Another important aspect of the mind-body problem has been concerned with the explanation and treatment of mental illness. Until fairly modern times the common



Patients who came to Mesmer's offices for treatment seated themselves around a tub filled with various chemicals and applied the iron rods protruding from the tub to the afflicted areas of their bodies. While appropriate music was played, Mesmer appeared in the darkened room and went from patient to patient touching them with either his hands or his wand. This treatment supposedly adjusted the magnetic balance of the patients, who were said to be cured by "animal magnetism."

explanation of mental disease was animistic—"insane" people were thought to be possessed by evil spirits. Long after the Middle Ages many people continued to believe in witchcraft—as tragically witnessed by the Salem, Massachusetts, witchcraft trials of 1692—and mentally ill persons were sometimes accused of witchery and hanged or burned at the stake. More often they were chained in dungeons or restrained in cruel devices.

The first effective reaction to this superstitious and inhuman attitude toward the mentally ill occurred during the French Revolution. At that time Philippe Pinel, a French physician, was appointed director of a Paris hospital where mental patients were confined. Appalled by the heartless manner in which these patients were handled, Pinel ordered the chains struck from their bodies and instituted a program of kind treatment. The major sig-

nificance of Pinel's work lies in his insistence that insanity was not the result of demons but rather was a disease which—like other diseases—could be cured or alleviated with proper care and treatment. This approach to insanity paved the way for the scientific study of mental disorders.

Experimental physiology. In the early nineteenth century there developed a flourishing school of experimental physiology which was destined to have great influence on the then nonexistent science of psychology. Discoveries about the brain and nervous system stimulated inquiries into the physiological basis of human thought, feeling, and behavior—inquiries which applied the experimental method of the natural sciences to specific aspects of the mind-body problem. The outstanding scientific figure of that period was Hermann Ludwig Ferdinand von Helmholtz, a renowned

German physiologist who is equally famous for his accomplishments in the field of physics. Among his many contributions to the ultimate development of psychology, Helmholtz measured the speed of the nervous impulse, set forth a theory of color vision, and offered an explanation for our perceptions of musical tones.

Other nineteenth-century scientists made equally significant findings regarding the physiological bases of experience. Johannes Müller demonstrated that the type of sensation one experiences is specific to the nature of the sensory nerve ending which produces it rather than to the nature of the stimulus. He also demonstrated the neural basis of vision. Max von Frey identified the nerve endings associated with the four skin senses of pressure, pain, warmth, and cold. While these discoveries were occurring in Germany, a French physician named Paul Broca identified a part of the brain (now called "Broca's area") which he concluded was the center for speech.

Psychophysics. The advances made in experimental physiology gave rise, about the middle of the nineteenth century, to a new field known as *psychophysics*. Gustav Fechner, who is considered the father of psychophysics, defined the field as the exact science of the functional relations of dependency between body and mind (Fechner, 1860). Actually, psychophysics was mainly concerned with determining the relationships between the physical qualities of stimuli and the psychological sensations they produce. In a typical experiment, for example, a subject gazes at a lighted area of a particular brightness. The intensity of the light is then raised or lowered until the subject reports a noticeable difference. Such a procedure permits the experimenter to measure the amount of change that must be made in the *physical* stimulus before a *psychological* change occurs in the associated sensation.

Psychophysics was the direct forerunner of experimental psychology. Indeed, one branch of psychology today is still devoted to the study of psychophysical problems.

WHAT IS PSYCHOLOGY?

As we have seen, until the late nineteenth century philosophy (based on speculation)

and physiology (based on experimental observation) were the two alternatives to the study of what we now know as psychology. The establishment of psychology as a separate science is customarily traced to the year 1879, when Wilhelm Wundt founded the first laboratory dedicated to the experimental study of conscious experience. Wundt's laboratory soon became a center of study which attracted such eager young students as E. B. Titchener and James Cattell, who brought the new psychological doctrine to the United States. Through the efforts of these pioneers, psychology secured its independence as a separate branch of scientific knowledge, and experimental psychology became fairly well established in America by the turn of the century. Having traced the long path toward its development, we might well inquire more specifically as to what are the distinguishing concerns of modern psychology.

PSYCHOLOGY STUDIES BEHAVIOR

Broadly considered, psychology is the field of study which seeks by scientific methods to describe, understand, predict, and control the behavior of living organisms. Literally, the word *psychology* means the "science of the mind," but scientists have never been satisfied with this definition because "mind" is a vague term and cannot be defined objectively.

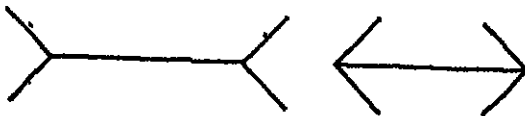
Changing emphases in psychology. Definitions of psychology have varied according to the theoretical orientation of particular "schools" of psychology. Wundt and his followers, who came to be known as *structuralists*, thought of their science as the study of conscious experience. They held that elementary mental states—such as sensations, images, and feelings—form the structure of consciousness and are directly observable through introspection. By careful empirical observation they sought to discover the physiological bases of various types of conscious experience.

Around 1900 another group of psychologists, led by John Dewey and known as the *functionalists*, criticized the structuralists on the grounds that their objectives were too narrow. The functionalists redefined psychology as the study of man's adjustment to his environment,—of the instruments he has evolved to aid him in adjustment and of the ways in which he can improve his adjustment through learning. They continued to be interested in conscious

experience and to rely somewhat on the method of introspection, but they expanded the scope of scientific psychology by putting a new emphasis on behavior and adjustment.

A third group of psychologists, the *behaviorists*, made a more complete break by insisting that conscious experience was beyond the range of objective observation and therefore was not a proper subject for scientific research. Instead they turned to the study of man's *overt behavior*, which they believed was determined by a complex system of independent stimulus-response connections. Although many ~~psychologists disagreed with the behaviorists'~~ assertion that conscious and unconscious experience had no place in psychology, this group—under the early leadership of E. L. Thorndike and John B. Watson—strongly influenced American psychological thought through their development of special research methods and their stress upon objectivity in research.

Protesting the assumption that mind or behavior can be viewed as constructed of single elements, the *Gestalt* school maintained that psychology should study the *whole pattern of behavior or experience* instead of trying to understand it by studying its elements. (The word *Gestalt*, brought directly into English from the German, means "pattern" or "configuration.") The Gestalt school, founded by Max Wertheimer around 1912, worked from the fundamental principle that the whole of experience or behavior is more than the sum of its parts. The parts, the Gestaltists pointed out, take much of their character from the whole. A good example of what they are talking about can be seen in the following example of two lines which are exactly the same length but appear to be different because they are in different wholes. Gestalt experimenters have used introspection as well as the objective methods of the behaviorists.



Around the turn of the century, at about the same time that functionalism began to thrive in America, the school of *psychoanalysis* came into existence in Europe under the leadership of Sigmund Freud, the famous Viennese physician and psychiatrist. In his attempt to

find the cause and cure of personality disorders, Freud postulated the existence of *unconscious mental processes* which influence the individual's behavior in various indirect ways, even though the individual himself is unaware of them. Unquestionably Freud's ideas have exerted a profound influence on personality theory and on methods of treating personality disorders; but as a school of psychology, psychoanalysis is seriously limited. It has little to say, for example, about such traditional problems in psychology as the nature of the learning process and the organization of human abilities. Psychoanalytic theory has been criticized too for the fact that it is based solely on clinical findings and has received no experimental verification. Psychoanalysis will be discussed in more detail in Chapter 8, where we shall consider various methods of psychotherapy.

Few psychologists today adhere wholeheartedly to one or another of these schools of thought but rather recognize the contribution that each has made to broadening the viewpoint of psychology and clarifying its scientific objectives. Most contemporary psychologists would agree on a definition of psychology as the *science of behavior*. By "behavior" they mean, first of all, external behavior that can be observed objectively—both the isolated reactions of muscles, glands, and other parts of the organism and the organized, goal-directed patterns of reaction which characterize the total organism. Many psychologists would interpret "behavior" to mean also internal behavior—thinking, emotional reactions, and the like—which can be inferred from external behavior.

Although psychology has been concerned primarily with the behavior of individuals, it has also embraced the study of group behavior and animal behavior. Animals have long held an important place in psychological laboratories, primarily because they can be subjected to strict experimental control. Experimental requirements often involve drastic interference with the normal living routine of subjects and sometime even endanger their lives or health. Animals make fit subjects for such experiments, whereas human beings obviously do not. Another advantage of studying animals is that psychologists often can gain new insights into the complexity of human behavior by observing and interpreting the relatively simple behavior of lower organisms. Although great care is always necessary in interpreting

human behavior in the light of findings from animal experiments, animal psychology has nevertheless shed much light upon our study of humans. It has also led to the development of important experimental techniques for investigating the behavior of living organisms.

Other sciences contributing to psychology. The intricate structure of human behavior is determined by a complex of factors that are partly biological, partly anthropological, partly sociological, and partly psychological. As the study of behavior, psychology is closely related to both the biological and the social sciences. Although there is a great deal of necessary—and, indeed, desirable—overlapping between these various areas of study, each has its own particular emphasis.

Biology studies how all living things grow, repair their bodies, reproduce their kind, and carry on other life processes. The biological sciences most closely related to psychology are *physiology*, the study of the functioning of living organisms and their parts; *neurology*, the specialized study of the brain and nervous system and the diseases thereof; *genetics*, the study of hereditary processes; and *embryology*, the study of the growth and development of embryos.

Anthropology studies the physical evolution of mankind, the origins of races, and the development of civilizations. Its examination of widely divergent cultures—particularly the so-called primitive ones—has provided psychology with much significant data for determining the influence of cultural factors on human behavior patterns.

Sociology studies the cultural conditions and social institutions which are evolved by people living in groups and which in turn influence the behavior of individuals belonging to those groups. It has helped psychology to understand not only group behavior but the influence of social environment upon the individual.

Psychologists, sociologists, and anthropologists have found that they can contribute very significantly to each other's efforts. As a result there has developed a new coordinated discipline known as *behavioral science*, with emphasis on the problem of developing valid generalizations about human behavior in group situations. Important work in this area is being carried out in a wide variety of institutions and agencies, and an increasing number of books and articles deal specifically



The goat above has been conditioned so that he lifts his leg ten seconds after a light has been dimmed in order to escape being shocked. Animals of all kinds—rats, dogs, cats, apes, raccoons,—are used in experiments covering a wide variety of problems in perception, learning, problem solving, and other areas. Animals are often used instead of human beings because of their relatively simpler behavior and because they may be subjected to the strict requirements necessary in some experiments—such as isolation from birth or destruction of some portion of the brain.

with the subject. A magazine, *Behavioral Science*, contains articles on general theories of behavior and on research aimed at testing these theories. An interdisciplinary approach is stressed in this magazine and also, as you will see, in this text.

PSYCHOLOGY STUDIES

BASIC HUMAN RELATIONSHIPS

In order fully to understand human behavior, psychology must study man in relation not only to himself but also to other individuals, to groups of which he is or is not a member, and to objects in his physical environment. The basic relationships with which psychology is concerned can be divided into five categories: (1) person-to-person relationships, (2) person-to-group relationships, (3) group-to-group relationships, (4) intrapersonal relationships, (5) person-to-object relationships. Each of these will be defined and illustrated in turn.

Person-to-person relations. The simplest form of social interaction is a relationship be-

tween two individuals. Your daily newspaper is full of dramatic examples of person-to-person relationships. Behind each announcement of a marriage or divorce, for instance, lies a story of a successful or unsuccessful human relationship between individuals. The salesman who attempts to convince a prospective client of the desirability of his company's product or services must be skilled in techniques of human relations, and the high school girl who spends her weekly allowance on cosmetics is well aware of the importance of her personal appearance in achieving good human relations. Personal happiness depends to a large extent on the effectiveness of the relations we are able to build with other individuals.

Person-to-group relations. In his daily personal relationships man must frequently deal with groups as well as with other individuals. We all belong to various groups—school groups, church groups, family groups, political groups, clubs, fraternities, and other groups which form the structure of modern society. Good adjustment demands that we learn to maintain constructive, cooperative relationships with the groups with which we have contact—whether as members or as outsiders. Much human grief results from failure to do so. Our prisons, for example, are populated by individuals whose relations with society have been unsuccessful.

An individual's relations with a group may take many forms. He may renounce the group and become a hermit; defy the group and become a renegade or criminal; be a passive member, relying on other members to take the initiative and make the decisions; cooperate with and support the group as a loyal member; or gain recognition in the group and attain high office or some informal leadership role. This wide area of human relations is currently the object of much cooperative study and research by psychologists, sociologists, and cultural anthropologists.

Group-to-group relations. International tension today is solemn evidence of man's need to control relations among groups. Modern society is racked by discord among groups—wars between powerful combinations of nations, clashes between political parties, disputes between management and labor groups, and even feuds between families. Psychologists do not accept the idea that war and human discord are the inevitable results of an aggressive nature born in man. Rather they

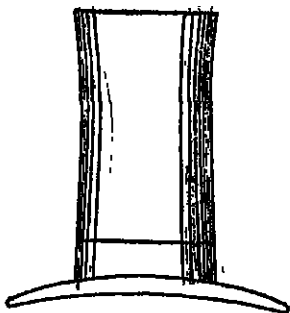
believe that problems of group relations can be solved in much the same manner as problems of individual relations.

Intrapersonal relations. One of the most interesting problems with which psychologists deal is that of intrapersonal relations—those psychological activities that occur within the individual himself. These activities, which constitute the "inner life" of the individual, occur commonly in such diverse activities as daydreaming, making decisions, and planning daily activities. As you become more familiar with the psychological facts and principles set forth in this book, you may often ask yourself, "How does this affect me?" Such reflections are part of your intrapersonal relations.

Sometimes it is as though there were two or more "you's." One of the "you's" wants to do a certain thing, but the other "you" says that such a course of action would be dishonest, unfair, or dangerous, and you experience a feeling of conflict or division within yourself. Many of the psychological "defense mechanisms" and emotional disorders described in later chapters are products of such intrapersonal conflicts.

Person-to-object relations. Man's existence, comfort, and happiness depend not only upon his interactions with other human beings but also upon his relationships with the objects in his physical world. Our most basic needs, such as food and shelter, demand that we control various objects in our physical environment. And wherever the human factor is involved in the use of a physical object, a psychological problem is also involved. Having developed nuclear weapons, automobiles, television sets, and automatic washing machines, for example, we are faced with the implications—pleasant and unpleasant—of their use. Even as you read the lines printed on this page you are interacting with a part of the physical world, and the psychologist is concerned with such problems as the nature of your eye movements and your understanding of these words.

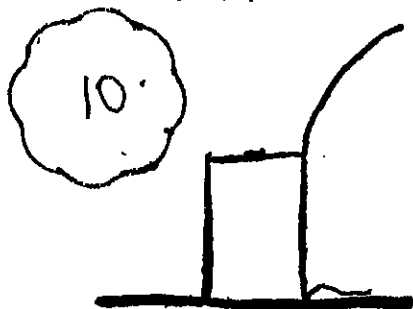
During the eighteenth century, European philosophers developed a doctrine called *idealism*, which maintained that physical objects exist not as realities but only as ideas in men's minds. Although modern psychologists do not accept this concept, they do agree that man's knowledge and understanding of the physical world, as it exists about him, is dependent upon his *perception* of it. That is, all the information man obtains about his en-



Environment comes to him through his senses, which do not always give him an accurate version of "reality." For example, are you sure the hat above is taller than it is wide? Check your judgment by measuring.

Since the relationships that man perceives between object and object are not always those that careful analysis proves to exist, psychologists are greatly concerned with man's perceptual processes. Psychological studies have shown not only how man's sensory equipment may play "tricks" on him, as in the example above, but also how the individual's perception of the physical world may be affected by his particular needs, past experiences, and expectations.

In an unpublished study two hundred college students were shown this drawing and were asked: "Which of these five objects does this drawing most resemble? (1) cooking utensil, (2) electromagnet, (3) hat, (4) chimney, (5) spool of thread."



Their responses follow:

Response	Males	Females
cooking utensil	3	16
electromagnet	42	1
hat	41	53
chimney	6	3
spool of thread	8	27
	100	100

Note that forty-two men as against one woman saw an electromagnet in the picture.

Men and women differ in their interests and past experience and thus they perceive different objects in the same objective situation.

PSYCHOLOGY STUDIES

THE PROCESS OF ADJUSTMENT

In order to understand the interplay of heredity and environment in determining human behavior, psychologists look upon man as a *reacting organism*. The term "organism" implies that, basically, man is a biological structure composed of a group of organs which work together to carry on life activities. This idea, which psychologists share with other scientists, is based on the assumption that man, like other natural phenomena, can be understood—that his thought, feeling, and behavior are capable of scientific explanation.

The process of adjustment. The interaction between man and his environment is a continuing process of *adjustment*—attempts to overcome inner and outer obstacles to the satisfaction of biological and social needs. When you have a tickle in your nose, you sneeze to ease the discomfort. When you are dissatisfied with the way your government is being run, you go to the polls and vote for new officials. Both responses are adjustment reactions, in one case to internal, biological stimuli and in the other case to external, social stimuli. In considering the stimuli which initiate human activity, psychologists use the term *environment* in its broadest sense. Environment is made up of social institutions and situations as well as physical objects. Moreover, every person has an internal environment which produces stimuli within his own body, such as the physiological activity associated with the feeling of hunger. No sharp line can be drawn between organism and environment. Who can say, for example, at what point food ceases to be environment and becomes part of the organism?

While human living is a constant process of adjustment, that adjustment may take many forms. For example, when an individual adjusts, he may either change his environment (as when he moves to another town to obtain a better job) or make a more adaptive response to his present environment (as when he goes to night school to improve his opportunities for promotion). Whatever form adjustment takes, it always involves a complex relationship between the individual's needs,

the opportunities the environment provides for satisfying those needs, and the individual's own ability to make the most of those opportunities. Adjustment need not mean conformity. In fact, one of the elements in creativity and invention is the desire to get away from things as they now are—to change the way some part of the world is run.†

Behavior patterns. In psychological terminology, a sequence of actions which the organism employs to adjust to a particular situation in the outer world or within itself is called a *behavior pattern*. Coughing, sneezing, slapping a mosquito, walking, eating, jumping out of the way of an automobile, and voting at an election—all these are behavior patterns. Some behavior patterns, such as suddenly withdrawing the hand from a hot object, are very simple indeed and may occur without full action of the brain. Other patterns, such as the "brainwork" involved in solving a geometry problem, are extremely complex.

Man functions as a whole. Many activities go on at once in the human organism when it is in contact with its normal environment. Yet man behaves as a whole in the sense that, even though he may be reacting to an intricate pattern of stimuli, he does *only one main thing at a time* (Sherrington, 1941).

When you are sitting in the library studying on a warm spring afternoon, you are stimulated in many ways. You see and feel the book in your hand, hear the low voices of students whispering at the far end of the room, feel the spring breeze blowing in the window, and smell the fresh new grass outside. Yet in spite of all these stimuli acting upon you, you try to concentrate—with varying degrees of success—on the words on the page before you. You may be responding to all these other stimuli too, but you are doing one main thing—studying.

In all daily life many activities are going on simultaneously in the human organism, but it behaves as a whole, doing one main thing at a time. Many secondary activities, of course, will also be taking place, such as breathing, sweating, or hearing disturbing noises. But the secondary activities either support the main thing that is being done or at least do not seriously interfere with it. When an activity is antagonistic to the one main thing it will be suppressed, or *inhibited*. Under normal conditions our activities are integrated into a

smoothly functioning whole. Many behavior patterns unite to form the total adjustment pattern of the whole organism. Man functions as a whole.

The organs of adjustment. The organs of the human body are divided into two chief groups, according to whether they (1) function internally to maintain the individual's health and growth or (2) function in the individual's activities in the environment as he overcomes obstacles to the satisfaction of his needs. The first group, which includes the stomach, alimentary canal, lungs, and digestive glands, are called the *organs of maintenance*. The second group, known as the *organs of adjustment*, includes the nervous system, certain glands, the skeleton, and the muscles. The organs of adjustment enable the organism to carry on such activities as food-finding, mating, working, learning, and thinking. The all-important circulatory system serves functions connected with both maintenance and adjustment.

Psychology is primarily concerned with the organs of adjustment rather than the purely vegetative or maintenance organs. The organs of adjustment fall into three distinct types of mechanisms, according to the function they perform: (1) the *receptors*, which receive stimuli and set up nerve impulses in the sensory nerve fibers; (2) the *connectors*, which carry impulses from the sensory nerve fibers to those of the motor nerves; these in turn lead to (3) the *effectors*, which are the organs performing the actual response functions of adjustment; these may be muscles or glands.

The receiving mechanisms. Every environment contains many different objects, most of which do not, at a particular moment, arouse the individual to activity, although they may potentially be capable of doing so. The parts of the environment that do make him react at any particular moment (or that are capable of making him react) are called *stimulus objects*. The word *stimulus* (plural *stimuli*) comes from the Latin word meaning "goad." In psychology a stimulus is regarded as some form of physical energy which is given off by a stimulus object and acts upon nervous tissue—some form of physical energy which, if it is strong enough, arouses nerve impulses in these cells. Thus a doorbell is a stimulus object, and the sound waves it emits are stimuli that enter a person's ear, creating the sensation of hearing which causes him to go to the door.

The structures of the nervous system which are in contact with the environment and are sensitive to stimuli that the environment produces are called *receptors*. Receptor cells are also sensitive to internal stimuli, such as the chemical secretions of certain glands. For each of man's "senses" there are special receptor cells. Thus the receptors for vision are located in the eyes, those for hearing in the inner ear, and those for smell in the nostrils. Our sense of body movement is provided by receptors located in the muscles, tendons, and joints. Receptors for the senses of pain, warmth, cold, and pressure are found in the skin throughout the surface of the body.

A receptor cell for a particular sense is sensitive only to certain specific stimuli. The eyes, for example, are not sensitive to sound stimuli, nor do the ears give us taste sensations. The fact that the receptors for each sense will normally respond only to specific stimuli is an important principle of physiological psychology.

The connecting mechanisms. Between the receptor and the effector is the vast nervous system, made up of millions of individual nerve cells called *neurons*. Although the receptor cells are an essential part of the nervous system, the vast majority of neurons serve as *connectors*. The excitation which is set up in a receptor cell is transferred as a *nervous impulse* along a complicated pathway or chain of connector nerves until it reaches the appropriate organ of response. In man, the connection between receptor and effector is rarely direct, usually passing through the brain or at least the spinal cord.

The bloodstream also functions as a coordinating mechanism, playing a very important role in the coordination of the various activities of the body. The effect of activity on one region of the body may be transmitted by the bloodstream to other parts. For instance, if a muscle of the right arm is exercised to the point of complete fatigue, the other muscles of the body will become a little tired. One explanation of this is that chemical substances produced by exercising the arm muscle are distributed by the blood to all parts of the body.

Coordination also occurs through the action of other chemical substances known as *hormones* (Chapter 2). The word "hormone" comes from the Greek word meaning "I excite." In sudden fear, for example, a certain

ductless gland becomes quite active and pours its secretion into the bloodstream which in turn takes it to all parts of the body. This brings about such widely diverse activities as dilation of the iris of the eye, constriction of the blood vessels in the wall of the stomach, and an increase in the rapidity with which blood clots in the presence of air. Hormones play an extremely important part in coordinating various body activities, and they have a great influence on physical and mental development and functioning.

The responding mechanisms. The organs of response, which perform the actual adjustive reactions of the organism, are called *effectors*. These are the glands, which secrete, and the muscles, which contract. Their action involves manipulation or change of the individual and of the external world surrounding him.

Suppose, for example, that the temperature of the room in which you are studying becomes too high for comfort. You turn off the radiator valve. The action of a group of muscles in response to the stimulation of a group of receptors has brought about a change in your external world. Glandular responses also help sometimes make the world more liveable. If you get a cinder in your eye, tears are secreted in quantities sufficient to help wash it away. A glandular response of this sort is adaptive in the same sense as the muscular activity in the preceding example.

Simple or complex, behavior patterns are essentially the same in that (1) they serve to help the organism adjust to a situation, and (2) *neural patterns*, or series of connections between receptors and organs of response, underlie each and all of them. All psychological activity—human thinking, feeling, and doing—depends upon the biological functioning of the organism. Modern psychologists, in contrast to the early European philosophers, have come to look upon mind and body as inseparable aspects of the total reacting organism.

OBJECTIVES OF PSYCHOLOGY AS A SCIENCE

The objectives of psychology are based on needs which man has experienced since the dawn of time—to *describe*, *understand*, *predict*, and *control* the conditions and situations that he meets in his environment and within himself. In striving toward these objectives,

psychology establishes its first point of kinship with the other sciences. Its second point of kinship is the use of objective methods of observation to obtain verifiable facts.

Describing, classifying, and measuring. The world is full of so many things that the human mind cannot possibly deal with all of them individually. Even though the area of human relations is just a part of the entire world, it is sufficiently vast to contain more facts than the mind can readily grasp. One of the main tasks of the scientist in psychology, as in any other science, is to group or classify his facts into meaningful categories on the basis of stated elements of similarity. Until this is done, understanding, prediction, and control are virtually impossible.

Scientists employ two basic kinds of classification: *qualitative* and *quantitative*. The line between the two is not entirely distinct.

Qualitative classification. In a qualitative classification, items are grouped in categories on the basis of some particular quality or characteristic they have in common. People, for example, can be classed as males or females; as blondes, brunettes, or redheads; as Republicans or Democrats; as married, single, widowed, or divorced. For more precise scientific study, members of a class may often be divided into various subgroups. For instance, if people are classed as blind or sighted, those with sight can be further classed as normal or color-blind.

Although the persons grouped into a particular class may resemble or differ from each other in a number of ways, they are all alike with regard to the characteristic by which they were grouped. Equally important, each member of the class is different from members of all other classes in respect to this particular characteristic, although they may be either alike or unlike in characteristics not classified.

The important thing about qualitative classification is that the classes or categories are not related to each other in a mathematical or quantitative manner. Qualitative classification is primarily a process of sorting items into groups and naming the groups with appropriate labels.

In addition to its value as an instrument of scientific inquiry, qualitative classification in psychology frequently produces results of considerable practical value. For instance, research conducted with personnel in the insurance business has shown that married men

generally make more successful insurance salesmen than single men. Thus, by classifying all applicants for jobs as insurance salesmen into the qualitative categories of "married" or "single," we can predict which qualitative category a particular applicant is most likely to fall into (successful or unsuccessful) should he be hired and trained as a salesman.

Quantitative classification. In a quantitative classification, people or other items are grouped into categories on the basis of some variable characteristic which can be measured on a mathematical scale. This permits us to say that, in regard to that characteristic, each person or object rates either higher or lower than others being measured. The categories are usually labeled in terms of numerical values which imply mathematical relationships between classes. For example, we can classify students according to the number of credits for which they are enrolled in school. The number-names (10-units, 12-units, 15-units, and so on) designate the relationship between the groups of students in terms of their scholastic work-loads. By knowing to which category a student belongs, we can tell whether he is taking more or fewer units of study than a student from another category, and can express mathematically the amount of the difference in their loads.

The prerequisite to quantitative classification is measurement. A characteristic which can be measured and expressed in numerical terms is sometimes called a *dimension*. Some dimensions frequently used by psychologists in classifying human beings are: age, intelligence, emotional stability, auditory acuity, and reaction time.

Such things as grade-point average, intelligence quotient, and reading speed are products of measurement and are called *scores*. Quantitative categories are usually labeled in terms of such scores. Even when we use descriptive terms such as tall or short, young or old, there is often an implied numerical score—in this case, number of inches or number of years.

The psychologist's ultimate aim is to make all classifications quantitative, though in many areas he is still a long way short of this goal. The psychologist prefers to work with quantitative categories because he can often make his predictions more directly when the available information (sometimes called "predictors") and the information he is trying to pre-

dict both fall conveniently into numerical categories.

Understanding and explaining. Science is a child of curiosity, born of man's craving to understand his natural environment. The goal of the scientist is to explain—to bring order and understanding out of the confusions and complexities of nature, of which man himself is a part. Thus one of the basic operations of psychology is to interpret and order facts about human nature into general, useful principles.

To achieve scientific understanding, however, the scientist must go one step further and organize his set of principles into a logical framework which demonstrates in an orderly, consistent manner how facts and principles are related. Such a systematic statement of relationships is called a *theory*. The value of a theory is measured in terms of its capacity to make otherwise unrelated facts meaningful. Although facts do not change with time, the observation of new data often makes it necessary that theories be modified or discarded. In such cases the scientist tries to formulate a new theory which will embrace all the known, relevant facts and explain them as fully as possible.

When understanding is sought scientifically as an end in itself, we speak of *pure science*, as distinguished from *applied science*, which uses scientific knowledge for some practical purpose. In the modern sciences, however—and particularly in the social sciences—the distinction between pure and applied science is regarded as artificial and is largely disappearing. Both are alike in that they start with the statement of an hypothesis and then test it experimentally.

Prediction. In addition to his desire to understand nature, man throughout history has sought to know the future—to predict and prepare for events in advance of their happening. In ancient times oracles and soothsayers held honored positions, for they were credited with a supernatural ability to reveal the future by reading signs from the gods. Man has gradually abandoned such supernatural beliefs, however, and now relies largely on science for predictions of things to come.

To make a scientific prediction we must first establish a relationship between persons, events, situations, and conditions. For example, most universities administer carefully prepared examinations to prospective stu-

dents who apply for admission. A comparison of students' scores on these tests with their later success in college has indicated, over a period of time, that students who make high scores are more likely to succeed in college than those who make low scores. Thus, from the score an individual makes on an entrance examination, we are able to classify him as either a potential success or a potential failure. In other words, we can *predict* whether or not he is a good bet to succeed in his college career. In pure science we also use prediction in testing hypotheses.

Control. Man's need to plan, control, or regulate human activities creates a fourth major objective for psychologists. Of course, control in the sense of a "sure cure" is not always possible. During the few decades since psychology has been established as a science, however, our ability to plan many aspects of human behavior has increased considerably. One example of this is in the field of vocational guidance. Over a period of years psychologists have been able to determine how success and satisfaction in various occupations are related to abilities, interests, and other human characteristics. Utilizing this knowledge, the vocational counselor is able, through personal interview data and scores on psychological tests, to "diagnose" his client. That is, he can tell him which vocational fields are most likely to offer him success and happiness and which, on the other hand, he should probably avoid.

In his efforts to insure job satisfaction for all employees, the industrial psychologist has gone even further. Applying knowledge gained from scientific research, personnel workers in large factories and businesses are constantly striving to maintain pleasant working conditions and good employee morale. Such things as company news bulletins, periodic "coffee breaks," employee suggestion boxes, and afterwork social functions are examples of modern personnel practices which have been shown not only to improve the employee's satisfaction with his job but also to make him perform his job more efficiently.

Control based on the accurate *prediction* of behavior is only one possible type, however. Adequate control often involves the *modification* of behavior. In the field of vocational rehabilitation, for instance, persons who have physical handicaps resulting from injury or disease are taught new skills that will enable

them to work and to return to normal living. Youth centers aid in the prevention of juvenile delinquency by teaching new social skills and attitudes. Still another example of control through modification is seen in the effects of psychotherapy, which often enables the troubled person to resolve his problems through greater self-understanding.

As a young science, psychology on the whole has devoted more of its energies to observing and explaining than it has to controlling. It can be expected, however, that as modern psychology gathers more and more knowledge about the causes of human behavior, it will turn its attention increasingly to applying that knowledge—that is, to the problems of control. It will be able to say, with growing certainty, that "if certain conditions exist, then certain behaviors will predictably follow" (Rogers, 1956).

The ability to influence and manipulate behavior offers many exciting possibilities for bettering social and working relationships, making education more effective, improving the techniques of psychotherapy, and so on (Rogers and Skinner, 1956). Considerable progress has already been made in these directions. But control is also potentially dangerous. The frightening success of "brainwashing" techniques, used by some governments in recent years for political and military purposes, has highlighted dramatically not only the potential effectiveness of psychological control but also the practical and ethical problems it poses. One of the country's foremost physicists, Robert Oppenheimer, said in a speech to the American Psychological Association:

"The psychologist can hardly do anything without realizing that for him the acquisition of knowledge opens up the most terrifying prospects of controlling what people do and how they think and how they behave and how they feel. This is true for all of you who are engaged in practice, and as the corpus of psychology gains in certitude and subtlety and skill, I can see that the physicist's pleas that what he discovers be used with humanity and be used wisely will seem trivial compared to those pleas which you will have to make and for which you will have to be responsible" (Oppenheimer, 1956).

Perhaps the greatest challenge psychology will have to face in the years ahead will be seeing to it that the scientific advances it makes are used for the benefit of mankind.



The control of human activity—a major goal of psychology—can either benefit man or destroy him. Both the beneficial and evil aspects of control are revealed in modern military practice. The Air Force cadet above is taking a finger 'dexterity test, one of a series of psychological tests devised to determine the individual's service classification. By assigning each man to the job for which he is best suited, the Air Force achieves maximum operating efficiency and high morale. Imprisonment in "The Hole" (below) to break the will of a prisoner reluctant to talk illustrates one phase in the brutal control technique known as "brainwashing," introduced by the Communists during the Korean War. This photograph, however, was taken at an Air Force counter "brainwash" school for survival training, where going into the hole was purely voluntary.



SCIENTIFIC TECHNIQUES OF MODERN PSYCHOLOGY

The difficulty of the subject matter with which modern psychology deals is obvious to everyone. Human behavior not only is complex but it is variable from day to day, and no two persons are exactly alike. Human relations are by their very nature far less subject to accurate observation and measurement than those with which the physicist or chemist deals. As a relatively new science, furthermore, psychology has neither the rich background of collected knowledge that is available to the older sciences nor the same wealth of tested research methods. Nevertheless, modern psychology has tried to operate within the principles and restrictions of the other sciences.

OBSERVATION IN PSYCHOLOGY

The most basic process in psychology, as in any other science, is observation. Because the subject matter of psychology includes both overt behavior (actions, speech, gestures) and inner experience (feelings, perceptions, wishes), two kinds of observation have been employed in psychological research.

Introspection. One method of observation used by psychologists is that of *introspection*, already mentioned as the technique employed by Wundt and his followers in their study of conscious states and processes. By observing such processes as thinking and feeling in himself, the subject is able to furnish a report on conscious activities that might otherwise be overlooked. Certain problems in psychology, particularly those concerned with intrapersonal phenomena, can be studied only by introspection. Some of the techniques employed in the treatment of psychological disorders are based on the introspective approach.

You can familiarize yourself with the technique of introspection by conducting the following exercise: Think of your breakfast table this morning. Can you "see" the form of your plate? Can you "hear" the sound of silverware against it? Can you "taste" your breakfast food? Can you "smell" the coffee? How long do these images persist? How clear is each in consciousness? How does the clearness of your strongest image compare with that of actual

perception of those objects when they are before you? These are typical introspections.

With a little practice any normal adult can learn to perform simple introspections of this sort, but introspection cannot be used with young children, the feeble-minded, or adults who have not been trained in its technique. Similarly, the person who is color-blind, the one who is tone-deaf, or the one who is "taste-blind" cannot discover this fact about himself through introspection alone. This places a serious limitation on the method of introspection. Another important difficulty is that much of man's internal behavior is wholly or partially unconscious, and hence cannot be observed even by this method. The most serious limitation of the introspective method, however, is that its findings cannot be checked by another observer. The observer can do no more than analyze the subject's verbal report. This becomes a study of overt behavior, not consciousness. Obviously a psychology based entirely on introspective information would be distinctly limited.

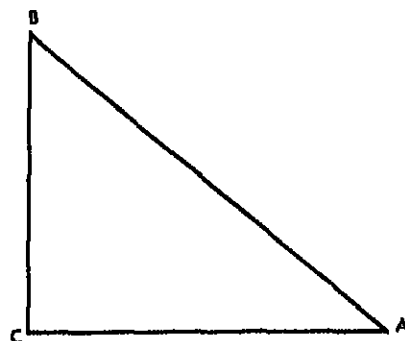
Objective observation. The second major technique psychologists use to observe behavior is *objective observation*. Here the experimenter notes what his subject *does*—not what he feels or thinks. The environmental conditions under which a response occurs, as well as the act itself, are systematically described in detail. Thus the situation can be duplicated or recognized by another worker, or by the same worker, at a later date. Complicated apparatus is frequently used to get graphic records of the subject's behavior. That such records can be analyzed by several psychologists adds greatly to the accuracy and value of this method.

Of course, in using objective observation we observe mainly what goes on in the external world, not what happens within the subject himself. This is its serious limitation. Some psychologists charge that this method gives us only the beginning and end of a response, while skipping the response itself; that is, it does not reveal exactly what happened within the individual himself in the adjustment of his behavior. On the other hand, this method, although it may not give a description of all that goes on in any subject, does permit us to study a wide variety of subjects—such as animals, children, the feeble-minded, and the insane—who cannot be studied by the method of introspection.

Introspection and objective observation combined. As you compare the two methods of introspection and objective observation—the one aimed at describing inner behavior and the other at describing outer behavior—you will notice that they supplement each other. Sometimes they are used in combination, as in the following experiment which was conducted to investigate the ability of blind people to orient themselves in space.

To determine the ability of the blind to orient themselves, two groups of subjects were used—one group totally blind and the other group sighted. Both groups were blindfolded and given two orientation tests. On a large concrete area outdoors, various-sized triangles similar to the diagram were drawn in chalk. In the first test each subject was started at point A and led by the experimenter along the path A-B-C. He was then instructed to return in a straight line directly from point C to point A. In the second test, each subject was led from point A to point C and then instructed to re-

turn to point A along the path C-B-A. On each test the subject's score was recorded in terms of his amount of error—that is, the number of feet he stopped from the starting point.



The results of these objective observations are summarized in the following table, which shows the average number of feet each group missed the starting point on each test.

	Blind	Sighted
Test 1	6.3	4.7
Test 2	6.8	5.0

Although these results indicated that the sighted subjects were more accurate in their space orientation than the blind, there is no explanation of the reason for this difference between the groups. To help solve this problem, the subjects were asked for introspective reports of their experiences during the experiment. Although many of the subjects could not explain their mental processes during the tests, some of the subjects in both the blind and sighted groups indicated that they estimated the time it would take to return to the starting point. The blind could give no other reason, but some of the sighted reported that they had visual images of the path. These reports led the experimenter to conclude that the blind rely primarily on time for distance estimation, while the sighted used time and visual imagery when blindfolded (Worchel, 1951).

As we have seen, the earliest psychological research used introspection exclusively, attempting to analyze and describe sensations, images, and other supposed "elements" of thinking. Later psychologists, in the interests of scientific rigor, went to the opposite extreme and studied only external behavior, because it could be observed objectively and subjected to measurement of some sort. It is generally realized now that the two methods used together give a more nearly complete description than either one does alone.



In this experimental study of adaptation to tactile pressure, the subject presses the telegraph key when she no longer feels the pressure of the weight on her knee. The complicated apparatus used to make the graphic records of the subject's behavior on the drum at left is typical of that used in many experiments involving objective observation.

Operational definitions. The accuracy of the facts a scientist can draw from his observations depends partly on the precision with which he defines the subject matter to be observed. Suppose, for example, that a psychologist wishes to observe the effects of hunger on behavior. Hunger may be abstractly defined as "need for food," but since a "need" cannot be observed directly, the psychologist must select a more satisfactory definition. In operational terms he might define hunger thus: "The subject displays hunger if, after a period of food deprivation, he eats when food is presented." (The psychologist uses similar *operational definitions* in studying such abstract concepts as intelligence, learning, memory, motivation, and emotion.) Formed in terms of observable events or operations, these definitions greatly increase the precision with which the psychologist can make and interpret his observations.

The psychologist uses two basic methods in his search for new knowledge—he *observes* the facts and *analyzes* the meaning of those facts. Obviously analysis is impossible in the absence of a quantity of observed, relevant facts, and the mere observation of isolated facts is dull and very nearly useless unless some attempt is made to see their interrelationships. As we shall see below, the scientist has various methods of observing and of structuring the conditions under which his observations are made so that they will become meaningful.

METHODS OF STUDY

Scientific understanding, in the form of generalized principles and theories, cannot be achieved simply by conducting a single observation or experiment. Usually a great many related observations must be made—often by a number of scientists over a period of years—before a principle can be established as valid. Many lines of evidence (facts) from different sources must be gathered painstakingly before meaningful generalizations begin to emerge. The scientist's problem in finding order and meaning in the apparent confusion of nature can be compared to the process of working a jigsaw puzzle. At the outset the puzzler is confronted with a confusion of small pieces of cardboard of various colors, shapes, and sizes. He may begin by grouping or classifying the pieces according

to their colors. Then follows a slow, laborious task of fitting the pieces together in their proper relationships until small portions of the picture begin to take form. Gradually these small parts are fitted together into a whole, meaningful picture. Similarly in science, each separate fact and observation is at first meaningless. But as these facts become properly classified they can be organized into principles, and the principles gradually into theories.

In any science several different methods of approach must sometimes be applied to the problem before all of the pieces fit together properly. Each method contributes in its own way to the final solution. Although experimentation is generally considered the most refined and formalized method of scientific inquiry, knowledge may also be obtained by various other methods. In fact, the experimental method is impractical in many types of investigation, particularly in the early stages of inquiry when the scientist may know little about the factors with which he is dealing. In planning a study, therefore, the scientist attempts to select the method most appropriate to the particular problem under consideration. The five chief methods that psychologists use are the field-study method, the life-history methods, the survey method, the experimental method, and statistical analysis. These methods are not mutually exclusive, and a variety of observational techniques and measurement methods are used in each.

Field-study method. The field-study method is the least complex of the research techniques used in any science. It is not a substitute for the experimental method but is often applicable where experimentation is impossible. (The field study might be described as a method of making critical observations of nature "in the raw.") The investigator simply goes into the field with a definite question or set of questions to which he is seeking answers and makes observations, without trying to control the conditions under which he studies his subjects. (Often the observer does not even need or request the direct cooperation of his subjects—in fact, field studies are sometimes most successful when the subjects are not aware of being observed.) In other instances the investigator finds it helpful to join in the actual life of his subjects for a time in order to gain a clearer understanding of their ways of living. The pictures and captions on



One difficulty in observing people's behavior is that the observer's presence tends to destroy the subject's spontaneity. This difficulty may be overcome by the use of a one-way screen through which the subjects can be watched without their realizing it. The observers can take notes and even freely discuss what is going on without disturbing the subjects.

page 139 illustrate the use of the field-study method.

✓ Life-history methods. Life-history methods of psychological research involve making intensive studies of individuals, usually in the attempt to trace the development of a particular form of behavior being investigated. In other words, the psychologist studies the conditions in the lives of various people which have led up to their becoming whatever they are: criminals, physicians, spinsters, political agitators, or what have you. By studying the antecedents of a specific form of behavior, he hopes to find its causes. Usually the life-history method takes one of three basic forms: the daybook method, the clinical method, or the biographical method.

The daybook method is most often used in child study. The child's development is carefully observed and recorded day by day. Such a record will contain descriptions of when the

baby first smiles, sits, stands, walks, and says his first word. When accumulated, records of this kind give us standards by which to judge the normality of the development of other children.

The clinical method represents an elaboration and extension of the daybook method. The life-history of a person is reconstructed on the basis of any information available, usually in an effort to discover the cause of—and solution for—some emotional or social adjustment problem. The most effective clinical study usually requires at least three professional functions. A psychiatrist or other physician examines the individual for signs of physical and mental illness; a psychologist evaluates his mental abilities and personality characteristics; a social worker examines the home conditions which surround and have surrounded the patient. The work of the clinic is not ended, however, when a full record has been obtained of the important influences in the patient's life. A good psychological clinic, unless organized and operated solely for research, provides for a follow-up to see that its recommendations are actually observed and to report on any progress shown.

The clinical method originated in connection with efforts to adjust problem children and social misfits, particularly as they were encountered by the juvenile courts. It has shown itself to be of such great value that its application is rapidly being extended to both children and adults who are less seriously troubled but who nevertheless are having adjustment problems of one sort or another.

The clinical method, then, is important in two ways. It gives us information concerning the emotional and personality adjustments of human beings. In this sense it is a means of observing and interpreting facts. It also attempts to modify behavior in the interests of greater personal and social welfare.

The biographical method is simply an attempt to obtain psychological understanding from an analysis of the records of men's lives as set down by themselves or others. An example of the use of the literary biography for psychological research is found in a study by the famous psychologist and educator, Edward L. Thorndike, who made personality analyses of ninety-one famous men on the basis of information contained in their biographies (Thorndike, 1950). Using evidence drawn from the writings, speeches, and actions of

these men, Thorndike undertook to rate each man in terms of forty-eight different personal characteristics such as intelligence, sensitivity, sociability, agreeableness, liking for beauty, liking for exercise, and so on.

The results of such biographical studies can be useful in giving us insight into the characteristics which underlie the achievement of greatness in various professional fields. There are certain important limitations, however, to the scientific value of this method. In the first place, the author's motivation is always a matter of question. The biographer may strive for a true record, but if his interest is great enough to motivate him to write, he may be expected to be biased either for or against his subject. In the second place, biographical accounts are not always sufficiently complete or accurate, for most biographers are not psychologists and may overlook seemingly insignificant incidents which were important in determining the course of the person's actions and achievements. For example, Lewis M. Terman, a psychologist who has devoted much of his life to the study of mental development, points out "the utter inability of a majority of otherwise competent biographical writers to appraise and interpret . . . the early mental development of their subjects" (Terman, 1926).

Survey method. When it is not feasible to spend a long period of time in the field or to obtain life histories of a number of individuals, much valuable information may be obtained by conducting a *survey*. In using this method the investigator, through written questionnaires or oral interviews, obtains data from a large group. It is important that he select the group carefully so that it will constitute a *representative sample* of the general population. Otherwise the data collected will be of little value.

A psychologist may obtain facts through a survey, or he may inquire about opinions. The latter type of survey is known as an *opinion poll*. Political opinion polls are perhaps most widely used, particularly in election years, but the opinion poll has many other uses. It is being used increasingly in industry as a means of improving relations between management and employees. We shall discuss surveys and opinion polls in greater detail in Chapter 16.

Experimental method. The most highly developed and formalized of all scientific methods is the experimental approach. Before

making any actual observations, the experimenter carefully defines and analyzes the problem under consideration to insure the greatest possible accuracy and clarity of results. A formal statement which defines the experimental problem, states the conditions under which the observations are to be made, and outlines the procedures to be followed in evaluating the results is called the *experimental design*. In addition to making possible more accurate observations, the preparation of an experimental design has the advantage of allowing the same experimenter—or other experimenters—to *repeat* the observations under the same conditions in order to *verify* results. Only with the experimental method can an investigator repeat previous observations with reasonable certainty that all conditions which might affect the outcome are being faithfully reproduced.

Another advantage of the experimental method is that it provides a procedure to *test* the validity of tentative principles that have been established on the basis of previously observed facts. This process of testing tentative conclusions is the underlying purpose of experimentation. Thus scientific understanding cannot be gained by experimentation alone, for this method can be applied only after some understanding of the problem has already been obtained by other, perhaps less exact, scientific methods.

Hypotheses in experimentation. Before conducting an experiment, the investigator must first formulate an *hypothesis*—a statement or proposition usually based on the results of previous observations. The purpose of the experiment, then, is to test the truth of the stated hypothesis. For example, it has been observed that some people display fear of snakes in varying degrees, while others (particularly children) have no such fear and may even adopt snakes as pets. On the basis of these observations, the experimental psychologist might formulate an hypothesis in such terms as: "Human beings possess no instinctive fear of snakes but may acquire such fear as a result of experience." The results of various experimenters who have tested this hypothesis support the conclusion that fear of reptiles is learned rather than instinctive, as we shall see in Chapter 6.

Between the formulation of an hypothesis and the actual testing of it, there lies an additional step—the *prediction of consequences*

implied by the hypothesis. Indeed, it has been said that prediction is the essence of testing an hypothesis (Shoben, 1955). In predicting consequences, the investigator analyzes what would logically occur in specific situations, presuming his hypothesis to be true. Each implication of the hypothesis must be stated in such a way that it can be tested experimentally. It is important to note, however, that an experiment never *proves* an hypothesis. If the results come out as predicted, the hypothesis is merely supported. The more experiments that support an hypothesis, the greater becomes the probability that the hypothesis is true.

Independent and dependent variables. The crux of the experimental method is in the procedures used for testing hypotheses. The scientific requirements for making experimental observations, for finding out whether or not predictions come true, are often difficult for the psychologist to satisfy. Man's behavior is affected by a great complex of interacting forces and events. What a person will do in the future depends upon his needs of that moment, his past training, his physiological condition, what he was doing last, the nature of the environmental conditions, and many other factors. It is the task of the psychologist to observe and analyze the specific influences of these various factors, or *variables*.

There are two kinds of variables with which the psychologist is concerned in conducting an experiment: the independent variable and the dependent variable. The *independent variable* is the factor whose effects are being examined. The experimenter is interested in observing what differences are produced when the independent variable is allowed to change in some systematic or predetermined manner while the other variables are held constant.

The *dependent variable* in an experiment is the factor which the experimenter predicts will change when changes occur in the independent variable. The test of the hypothesis is what happens to the dependent variable. If it changes in the predicted manner, the results are said to "support" the hypothesis; if the predicted changes fail to occur, the hypothesis is "refuted."

The specific contribution a variable makes in producing a certain condition can be determined only when that variable acts alone

against a background of constant conditions. If all variables but one are kept from varying—are held constant—then any change in a person's behavior must have been produced by the changing of that particular factor. Thus experimental observation requires that *all the factors which might produce a given result be held constant, except the one whose effects are being examined.*

Experimental control. The process of holding constant all variables which might affect the outcome of the experiment is called *experimental control*. The independent variable is controlled so that its effects may be studied more accurately. This is often done by dividing the subjects into "experimental groups" and "control groups." In a *control group* the experimenter holds the independent variable under experimental control either by keeping it constant or by removing it from the situation entirely. In an *experimental group* the experimenter alters the independent variable whose influence he wishes to study. In this way the effects of the independent variable can be determined by comparing the two groups.

It is important to note that in many situations the behavior of the dependent variable is caused by a *set of variables* working together. Thus, although the experimenter tries to hold constant all variables except one, the others may still be active—working in combination with the "independent" variable to produce changes in the dependent variable. In other words, sometimes the independent variable is really a *pattern or complex of variables*, rather than a single factor.

An experiment at the Lockheed Aircraft Corporation which was designed to investigate the effect of vitamins on employee absenteeism will serve to illustrate this point.

The hypothesis being tested was that vitamins given to employees would decrease absenteeism. Absenteeism was therefore the dependent variable and vitamins the independent variable. Other important variables were controlled by using three groups of subjects equated as to age, sex, length of service, and type of job. One group served as a control group, not even knowing that they were being used in the experiment. A second group received vitamins from the company free of charge. A third group was told that they were receiving vitamins, but in reality they were given capsules

containing inert ingredients. Both the true-vitamin group and the false-vitamin group showed reduced absenteeism, whereas the control group did not. The true-vitamin group had only slightly less absenteeism than the false group (Borsook, 1945).

Thus the real conclusion of this study (although not that of its author) would seem to be that the belief of some of the employees that the company was sufficiently interested in their welfare to give them vitamins had a favorable effect on reducing absenteeism even when vitamins were not actually given. Although vitamins themselves apparently had some slight effect on the dependent variable (absenteeism), change in the dependent variable was found to be more significantly related to another variable, namely, belief in employer interest.

Logical constructs. Sometimes, in order to understand why differences between experimental groups occur, it is helpful to imagine the existence of a quality or substance or process through which the independent variable operates on the dependent variable. A concept of this kind is called a *hypothetical construct* or *logical construct*, because it is invented or "constructed" by the experimenter as a logical explanation for what takes place in his experiment.

An example may be found in an experiment in which hungry rats were fed mash through the bars of a grid which could be charged with electricity. Ten seconds after the rats began to eat, the current was turned on by the experimenter. The animals in the experimental group could turn off the current by leaping off the grid, but those in the control group could not. They were shocked for exactly the same length of time as the others, but their own efforts had nothing to do with cutting off the shock. It was found that the experimental animals ate much oftener and more quickly than the controls. The experimenters assumed that there was a psychological factor, which they named "sense of helplessness," present in the control animals which caused them to eat less (Mowrer and Viek, 1948).

The "sense of helplessness" is the logical construct in this experiment. It is sometimes also called an *intervening variable*, because it intervenes between the variables controlled by the experimenter and the observed changes which take place in the dependent

variable. The use of the term "intervening variable" is ordinarily reserved, however, for those logical constructs which have been used in enough experiments to have developed a constant form or perhaps even to have become quantitative in nature.

Psychologists use many logical constructs in explaining such real but invisible processes as learning and forgetting. A person who has memorized a poem, for example, usually finds that after a month he can no longer repeat it all and that after a year he can remember even less of it, or none at all. In studying this process of forgetting, some psychologists have come to believe that when learning takes place, certain connections are formed in the nervous system and brain but that these connections are gradually destroyed unless maintained through practice. The concept of connections being built up and destroyed is a logical construct, because the connections cannot be observed directly. By using this construct, however, psychologists have been able to set up numerous experiments on the learning process and to discover many valuable principles which aid in learning.

Constructs of this kind can be especially valuable during the early stages of experimentation in a given field, but they must be clarified and made more specific in order to continue being helpful. Otherwise they may become empty abstractions that erroneously lead the investigator to think he understands a process merely because he has given it a name. Such concepts as "intelligence," "drive," "habit," and "emotion," are examples of logical constructs which have been extremely well defined over a period of time and are very useful to psychologists.

Statistical analysis. A fifth method of study used by psychologists is *statistical analysis*, often applied when directly controlled experimentation is difficult or impossible. When it is not feasible to control all the variables in experiments involving human beings, psychologists are often able to simulate controlled conditions by mathematical methods.

Statistical analysis is frequently applied to the results of experimental observations before conclusions are drawn from them. Suppose, for example, that an experimenter is studying the effects of age on golfing ability. In designing his experiment, the investigator would want to study players in different age

groups. Except for the factor of age, the subjects should be exactly alike in such respects as their size, the kind of coaching they have received, the type and difficulty of the course they play on, and their desire to play golf. Obviously, with so many variables involved, it would be extremely difficult to obtain groups perfectly matched in all respects. After obtaining groups which were equated on all these variables, the experimenter might find, for example, that they were not matched in terms of previous experience. Since experience as well as age can be presumed to affect playing ability, the results of the experiment would be ambiguous. However, by using appropriate statistical formulas, the experimenter could determine the degree of relationship between playing experience and playing ability and then cancel out the effect which the uncontrolled variable exerted on his results. In effect, a freely operating variable is thus held constant artificially by the use of statistics.

*Psychology also uses statistical analysis in studying complex tasks and skills which involve the use of several separate abilities operating together. Consider, for instance, the separate abilities required to solve a simple story problem in arithmetic, such as: John has four apples and gives half of them to his sister. Mary is John's only sister. How many apples did Mary get? Although any educated person would find this problem extremely simple, his ability to solve it involves such separate factors as reading comprehension, reasoning, and numerical ability. If he lacked any of these abilities completely, he would find the problem impossible to solve.

In order to study the processes involved in performing complex tasks, it is necessary to study all of the separate abilities as they function together. One of the most common statistical methods for studying problems of this sort is a complicated technique known as *factor analysis*, which will be discussed further in Chapter 8. The purpose of factor analysis is to identify the underlying variables which contribute to a complex skill and to measure their relative importance. The following table, depicting the percentage which each of several factors contributes to achievement in a technical course for Air Corps mechanics, illustrates the type of results obtainable through factor analysis (Fruchter, 1952).

Factor	Percent of Contribution to School Achievement
numerical facility	9.6
verbal comprehension	6.8
perceptual speed	2.2
mechanical experience	54.8
ability to visualize	19.4
others	7.2

During recent years statistical methods have become an increasingly important part of the scientist's equipment, particularly in psychology and the other social sciences where variables often cannot be controlled directly. The use of statistics in measurement will be discussed in greater detail in Chapter 8. Statistical analysis, with experimental observation, represents the psychologist's most precise method for achieving an understanding of human nature. (See pages 528-531.) (2)

S U M M A R Y

Because man has always sought to understand himself, many philosophic and pseudo-scientific explanations of human nature preceded the science of psychology. Among these were such characterologies as the *humoral theory*, which paired temperaments with predominant body fluids, and *phrenology*, which held that personality was determined by "faculties" located in specific areas of the brain. More recent examples of characterologies are the *body-type theories* of Kretschmer and Sheldon.

The development of psychology, the science of behavior, owed much to the school of *experimental physiology* and its offshoot, *psychophysics*. Psychology was first established as a separate science in 1879, when Wundt set up a laboratory for the study of conscious experience. Wundt and his followers came to be known as *structuralists*. Gradually other groups of psychologists began to emphasize other aspects of behavior. The *functionalists* emphasized more specifically the processes by which man adjusts to his environment; the *behaviorists* limited their study to overt behavior as it could be observed objectively and stressed the impor-

lance of stimulus-response connections; the *Gestalt* school stressed the importance of studying total patterns of behavior rather than isolated elements; and the school of *psychoanalysis* stressed the role of unconscious mental processes in personality development and disorders.

Although psychology studies many specific aspects of behavior—animal as well as human—its main emphasis is on *behavior as adjustment*. In studying man as an organism of adjustment, psychology must be concerned with various *basic human relationships*—person-to-person, person-to-group, group-to-group, intrapersonal, and person-to-object. It also is directly concerned with the physiological mechanisms underlying adjustive behavior. These *organs of adjustment* are the receptors, which receive stimuli; the connectors, which carry nerve impulses; and the effectors, which produce the actual response.

The major objectives of psychology as a science are to *describe, understand, predict, and control* behavior. After gathering data by objective and introspective *observation* (or a combination of both), the psychologist classifies his facts into meaningful categories. *Classification* can be either qualitative or quantitative, although the latter is usually preferable because it makes possible more direct predictions. Predictions are a necessary part of testing hypotheses. As the psychologist gains in ability to make accurate predictions about behavior, he comes closer to reaching his

fourth objective—control. The possibility of effectively controlling human behavior has tremendous implications, both good and bad, and places a great responsibility on psychology for seeing that its advances are used to benefit mankind.

Among the methods of study used by psychologists are the *field-study* method; the *life-history* methods (including the *daybook, biographical, and clinical* methods); the *survey* method or opinion poll; and the *experimental* method. The most rigorously scientific of these is the experimental method, in which *hypotheses* are tested under carefully controlled conditions. To maintain *experimental control* the psychologist tries to hold constant all variables except the *independent variable*, which is allowed to operate freely so that its effects upon the *dependent variable* can be studied. Often the psychologist uses a *logical construct* to explain what happens in his experiment; that is, he imagines the existence of a quality or substance or process by which the independent variable operates on the dependent variable.

When it is impossible to control all the factors which may affect the outcome of an experiment, the method of *statistical analysis* may enable the experimenter to simulate controlled conditions mathematically. Statistical analysis has also enabled the psychologist to study the various processes involved in performing complex tasks. This is done by a procedure known as *factor analysis*.

CHAPTER TWO

FACTORS IN DEVELOPMENT

WHAT DETERMINES HUMAN DEVELOPMENT?

HEREDITY AND MATURATION

ENVIRONMENT AND LEARNING

PSYCHOSOCIAL DEVELOPMENT



When the newborn infant takes his first gasping breath and gives the cry announcing his birth, he is already a unique individual. Although still not even a fully formed organism, he possesses the potential for a complex—though as yet quite undeveloped—personality. The development of the human being from a minute, almost microscopic particle of protoplasm is a process which begins at conception and ends only at death. Birth is neither a beginning nor an end but only a reference point in an individual's life.

All of us share many characteristics—physical, emotional, intellectual, and social—with other members of the human race and particularly with other members of our own culture, but no two of us are exactly alike. One of psychology's major concerns is identifying the factors that make people what they are, for without this understanding it can never hope to achieve its goals of predicting and controlling behavior.

WHAT DETERMINES HUMAN DEVELOPMENT?

To understand the human personality you must understand how the development of the organism is controlled by the action of both *heredity* and *environment*. Man is a product of his nature and his nurture. The relationship between heredity and environment in producing the level of an individual's biological, psychological, and social development at any given time in life might be expressed as:

$$\text{heredity} \times \text{environment} \times \text{time} = \text{development level}$$

Heredity determines how high a level of development a given environment can bring about in a given period of time. Correspondingly, environment determines how effective a certain heredity can be in influencing development over a given amount of time. If any term in the formula were reduced to zero, the product (level of development) would also be zero. This is another way of saying that either heredity or environment is meaningless

alone. Both are necessary in determining an individual's development.

Up to the time of birth, an organism's development is mainly a biological growth process steered by heredity. This is not to say that the unborn child has no environment, for within the mother's body he is surrounded by protective tissues and receives nutritive fluids from the maternal bloodstream. But under normal conditions the function of the prenatal environment is mainly to support the normal growth processes of the unborn child.

Although opportunity to learn in prenatal life is very limited, it has been demonstrated that the human organism is *capable* of learning simple responses during the last two months in the womb.

In an experiment on prenatal learning, preliminary investigations showed that a loud sound made just outside the mother's body elicited innate body-movement responses, whereas a vibrator applied to

the mother's abdomen was not an adequate stimulus to cause the fetus to move. During subsequent learning trials the vibrator was applied to the abdomen for five seconds, during which time the loud sound was also produced. Fetuses moved in response to the vibrator alone after fewer than one hundred paired presentations of sound-plus-vibrator. There were marked individual differences, however, in the number of trials necessary for the response to be learned (Speltz, 1948).

After birth, learning begins to play a major role in determining new behavior patterns. Some kinds of development, however, are the result *not* of learning but of bodily changes determined by heredity acting over a period of time. This process is called *maturatlon*.

One familiar example of maturation is the voice change occurring in all normal boys at the age of puberty. The boy's voice becomes lower because of a thickening in his vocal cords which results from the increased functioning in a portion of the ductless gland system. Although the low voice which develops in the adult male is not present at birth, it is nevertheless determined by heredity, acting through maturation. Observation of boys who have grown up out of touch with other boys shows that even in the absence of knowledge of this change, the characteristic voice change takes place at adolescence. Clearly, therefore, it is not something that is learned but is the result of maturation of structures.

A number of physiological structures are essentially mature and ready to function at birth or even earlier. Other essential nervous, muscular, and glandular structures are not ready to function until months or even years after birth. Until these essential structures are mature, no stimulus will be effective in producing the particular type of behavior which they will underlie.

The function of environment in determining an individual's developmental behavior is twofold: (1) the environment supplies the stimuli which set off patterns of response already prepared by maturation; (2) the environment also provides situations which are conducive to the person's learning new patterns or altering old ones.

All through life, learning helps shape our responses. As soon as the infant comes from the uterus, where he has neither much need nor opportunity to learn, his basic inborn behavior patterns are altered and enriched through contact with his environment.

Heredity and environment are the two chief determinants of development, but from their interaction emerges a new and important factor—the individual, or the *self*. As an individual grows in awareness of his body and of his world, he gradually develops ideas, feelings, values, habits, skills—all of which are uniquely his own. The *self*, as the term is used here, refers broadly to all these things and more. It is the individual's own characteristic *frame of reference*, determining how he will perceive and react to his environment and the extent to which he will fulfill or deny his inherited potentialities—in other words, how he will adjust to life.

HEREDITY

AND MATURATION

An individual's hereditary endowment, determined at the time of his conception, has a great influence on his biological and psychological characteristics as they later develop. Actually, of course, the moment at which a child is conceived does not represent the true beginning of his life, for life is an endless stream—*generation follows generation* without beginning or end. For convenience, however, we must accept the moment of conception as the start of life.

The process by which an individual develops from a single-celled organism into an adult human being, with his many billions of cells and his remarkable physical and mental capacities, is wonderfully complex. Guided by genetic controls, however, it follows a definite pattern. Although each individual follows his own particular schedule of development—determined by all the events and conditions that surround his growth—psychologists and physiologists have been able to outline a general developmental schedule which, under normal conditions, is characteristic of human development. Knowledge of this schedule, which is based on a comparison of great numbers of individuals, not only aids our understanding of the human organism generally but gives us a helpful background against which to study individual development.

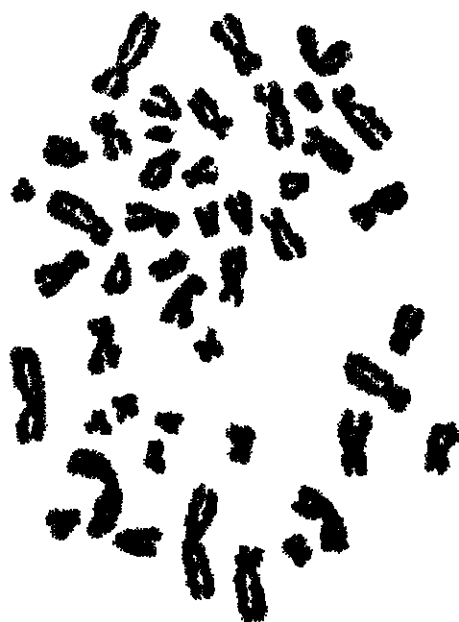
HOW WE INHERIT

During conception two living *germ cells*

(the *sperm* from the father and the egg—or *ovum*—from the mother) unite to produce an individual. The male and female germ cells, technically known as *gametes*, form a single cell called the *zygote*. Within both the sperm and the egg are ropelike structures called *chromosomes*. The gametes are unique in that they contain only *half* the number of chromosomes found in other body cells. Thus, the zygote they form contains the normal number of chromosomes—half from the egg and half from the sperm.

Geneticists have long believed that the zygote contained forty-eight chromosomes. However, the latest available evidence seems to indicate that, at least in a great many individuals, there are only forty-six. Using modifications of a new "spreading" technique developed by T. C. Hsu, plus highly refined techniques of lighting and photomicrography, two Scandinavian investigators were able to count the chromosomes with considerable assurance of accuracy (Tjio and Levan, 1956). Formerly it had been impossible to spread the cellular material thinly enough, and the chromosomes tended to overlap each other to such an extent that the exact number was difficult to determine. Tjio and Levan's count revealed only forty-six chromosomes in 261 out of 265 apparently undamaged human embryonic lung cells. The other four cells contained forty-seven or forty-eight, but the investigators believed the extra chromosomes were displaced from adjacent cells during the smearing process. Two other investigators, studying male reproductive cells, have supported Tjio's and Levan's tentative conclusion that the normal number of chromosomes in human cells is forty-six (Ford and Hamerton, 1956). However, the recent findings of a Japanese investigator suggest that the problem is by no means settled (Kodani, 1957). Using two different methods of spreading and staining so that he could check his results, Kodani discovered forty-eight chromosomes in most of the cells he studied but only forty-six or forty-seven in others. His comparisons of the photomicrographs of the chromosomes suggest that the extra pair in the forty-eight-chromosome cells are simple and very small.

These recent studies have reopened the question of how many chromosomes there are in human cells. Since the long accepted number of forty-eight chromosomes is now in some doubt, we must wait for further investigation and evaluation before we can reach a final



Forty-six was the usual number of chromosomes found in the Tjio and Levan study of human embryonic lung cells, as shown in their photomicrograph above.

conclusion concerning the normal number of chromosomes in man and whether there are differences between individuals, races, or sexes. This typifies the scientific procedure. As new research techniques are developed, scientists use them to reexamine the evidence. Earlier conclusions can thus be qualified as necessary or tentatively confirmed.

At present we may say that the zygote receives an equal number of chromosomes from the egg and from the sperm. These chromosomes line up in the zygote and function as pairs. As the zygote divides and redivides itself into more cells, the chromosomes duplicate themselves, so that there are the same number in every mature body cell.

Many lines of evidence from the field of *genetics* (a branch of biology which studies the mechanics of heredity) leave little doubt that the determiners of a person's hereditary characteristics are locked within the chromosomes. In each of them are ultramicroscopic areas called *genes* which are the real bearers of a person's heredity. All of the chromosomes together carry an estimated ten to fifteen thousand genes, each composed of some substance, or containing some structure, which is absolutely essential to the development of a

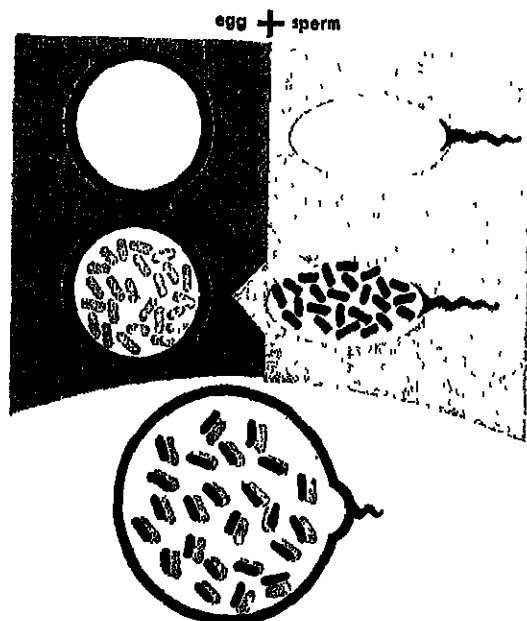
particular characteristic of body or behavior. Exactly how the genes exert their influence is still largely unknown, although it is believed that a chemical interaction takes place between them and the cell material surrounding them. The total heredity of the individual consists of many characteristics, each determined by a gene, a pair of genes, or a group of genes working together.

Since the fertilized egg receives exactly half of its chromosomes from the father and exactly half from the mother, the child does not (despite popular belief) inherit more characteristics from the parent of his own sex. However, the characteristic of sex itself is determined by male gamete alone. Whereas the sex-determining chromosomes of the female are all of the same kind, called "X-chromosomes," a mature male reproductive cell may contain either an X-chromosome or a different kind called a "Y-chromosome." If a male sex cell containing an X-chromosome fertilizes an ovum, the child will be a girl; if the male cell has a Y-chromosome, the child will be a boy. Thus the father who is disappointed when the doctor says "It's a girl" has no grounds for blaming his wife. The father who hopes for a boy has the odds slightly in his favor, however, for statistics show that 106 boys are born for every 100 girls.

Identical and fraternal twins. In certain areas of psychological research where it is important to control the effects of hereditary factors, psychologists frequently find it convenient to study *identical twins*. Identical twins are sometimes referred to as *monozygotic*, indicating that they develop from a single fertilized egg, or *zygote*. Shortly after conception the zygote splits into two separate cells which develop into two individual organisms. Since both babies originate from the same sperm and egg, they are assumed to have identical heredities and will resemble each other in sex as well as all other inherited characteristics.

In contrast, *fraternal twins* are called *dizygotic* to indicate that they have developed from two separate zygotes, each produced by the union of a separate sperm cell with a separate egg. In this case their heredities may be quite different. Fraternal twins may be of the same or different sexes and will not resemble each other any more closely in their hereditary make-up than ordinary brothers and sisters.

What traits are inherited? In the determination of human characteristics, heredity does not function as an all-or-nothing influence. Few if any characteristics are entirely the result of heredity, although its influence is



The baby originates in the **GAMETES**, the egg from the mother and the sperm from the father.

Within the egg and sperm lie the **CHROMOSOMES**, which contain ultramicroscopic genes—the real bearers of the individual's heredity. The egg and sperm are unique in that they contain only half the number of chromosomes that are normally found in all the other body cells.

When the egg and sperm unite into one cell, the **ZYGOTE** is formed. The chromosomes pair off, thus giving the zygote the same number of chromosomes contained in other body cells. The combination of genes thus formed determines the inherited characteristics of the child.

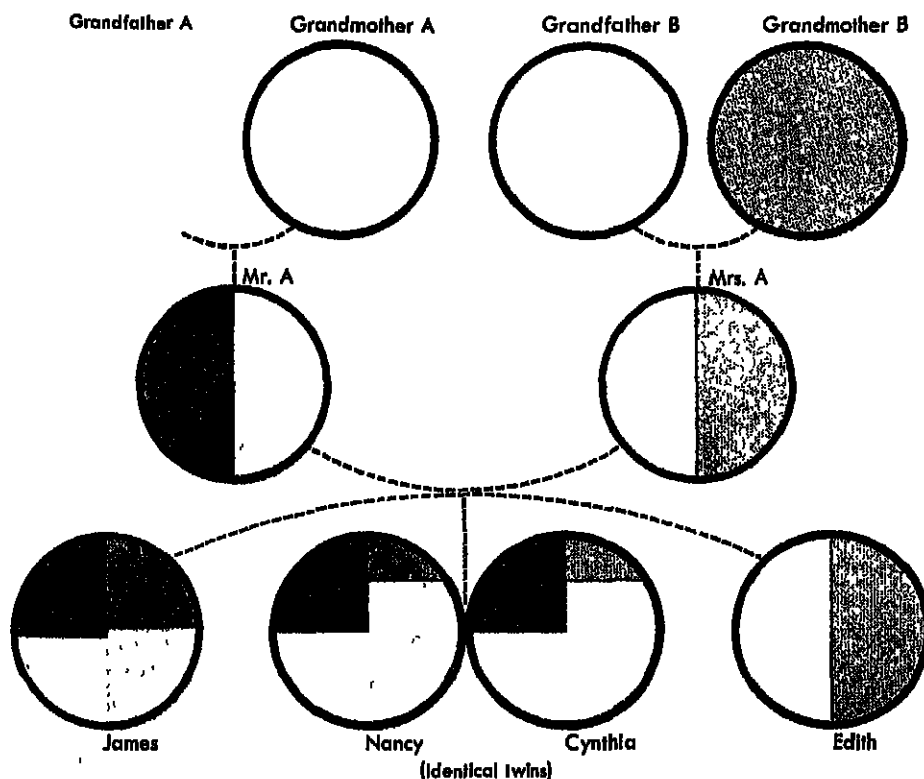
expressed to some degree in all traits. The characteristics most influenced by heredity include our physical features, motor skills, intelligence, sensory acuity, and other fundamental abilities and capacities. However, many of the human characteristics that concern psychology most directly, such as interests and character traits, are predominantly

determined by environmental influences and may be attributed to heredity only to a slight degree, if at all.

THE MATURATION PROCESS

The development of the human organism from the time of conception to maturity pre-

Why We Are Like and Different from Our Relatives



When cells divide in the course of normal body growth, every pair of chromosomes is duplicated in each new cell that is produced. But a special kind of cell division—*reduction division*—occurs in the development of the gametes, so that each mature egg and sperm contains only one chromosome from each pair. Thus only half of each parent's chromosomes are transmitted to each child. And because a process of chance selection determines whether a particular germ cell contains one chromosome or the other from each pair, different combinations of chromosomes—and different genes—are transmitted to different children of the same parents.

Look at the hypothetical "A" family above. Both Mr. and Mrs. A received half their chromosomes from each of their parents. Their children, in turn, will

receive half of their chromosomes from Mr. A and half from Mrs. A. But according to the laws of chance, each child will receive a different selection of chromosomes from each parent—and thus will receive different proportions (as well as a different selection) from each grandparent. The most likely proportions are those shown for James, who draws about equal numbers of chromosomes from all four grandparents. The proportions shown for Nancy and Cynthia are somewhat less likely; and those for Edith are highly improbable.

This process of reduction division explains why a child is both like and different from his siblings, parents, and grandparents, as well as other relatives not shown in the diagram above. Only identical twins, who develop from a single egg that splits in two, have identical chromosomes and genes.

sents certain characteristics that are always typical of the maturation process, whether in lower forms of life or in the most complex organs and systems of man. In the first place, *maturation follows an orderly sequence* (Dewey and Humber, 1951). From the very beginning of the prenatal period, new structures and functions always appear in a definite order, so that each new development sets the stage for the next.

In its orderly course, maturation proceeds along a physiological gradient. This means that it begins in the head region and gradually extends throughout the organism to the feet, as shown in the extension of the sensitive areas of the fetus. Maturation also proceeds from the trunk outward to the extremities, so that the child moves his shoulders before he can move his elbow, wrist, or fingers. The fact that maturation is orderly does not imply, however, that it is automatic. On the contrary, the innate potentialities of the organism can unfold only when environmental conditions are favorable.

As we shall have frequent occasion to note, maturation sets a limit to the effectiveness of environment in determining development. Because of the differences among individuals in heredity, *maturation is not uniform for all children*. Though the same general sequence is followed, there are noticeable differences in the rate, pattern, and extent of individual development.

The organism matures as a unit. Though the various parts of the organism mature at different rates, they are sufficiently balanced to enable the organism to adjust to its environment in a coordinated manner. In the earliest stages of maturation the whole organism usually reacts in a generalized, more or less random way; but as maturation progresses, certain parts become differentiated and integrated to produce more and more effective reactions. Thus the maturation process usually has three levels, as given by Murphy (1947):

1. A level of global, undifferentiated mass activity.
2. A level of differentiated parts, each acting more or less autonomously.
3. A level of integrated action based upon interdependence of the parts.

Most movements of the unborn infant are random and undifferentiated at first, but as time goes on they become more differentiated so that, for example, the hand can grasp with-

out involving the whole torso in movement. Coordination or integration, though based upon the interaction of the differentiated parts, takes place simultaneously with differentiation. Development "from the whole to the part, from the random to the orderly, and from the general to the specific" usually holds true not only of the maturation of body tissues and of muscular activities but also for the development of complex emotional and intellectual adjustments throughout life.

This pattern of *individuation*—of development from the general to the specific—is not an absolute law of growth. In studies of mammalian embryos, for example, it has been observed that certain reflexes appear in specific form without any generalized mass activity preceding them (Windle, 1944). Regardless of specific exceptions, however, individuation is a useful generalization when applied to complex adaptive behavior.

The principle of *motor primacy*. The neuromuscular structures of the body must reach a certain stage of development (maturation) before they are capable of responding to stimulation (Bousfield, 1953). For example, a child cannot perform a certain activity, such as walking, until he has developed the physical structures necessary for the activity, regardless of the amount of training he receives. In this sense the individual's maturational level at any given time limits the effectiveness of his environment in stimulating development. This is an important concept and will be referred to many times.

PRENATAL MATURATION

Secluded within its mother's womb, the prenatal child lives in an environment which is fairly constant from day to day and gives him little or no opportunity to learn. Since this is the case, development up to the time of birth can be attributed almost entirely to maturation. Accordingly, in the infant both in the uterus and just after birth, we have an opportunity to study the effects of maturation alone, before they begin to be interwoven with the effects of learning.

Stages of prenatal development. Between conception and birth the human being passes through a series of developmental "stages." The *germinal* period lasts for about the first two weeks. During this stage the zygote develops by a process of cell division into a

hollow sphere of cells about one fifth of an inch in diameter. Then the *embryonic* period begins, as the first primitive structures of the prospective child slowly begin to form. By the end of the eighth week the heart is beating, the internal organs have begun to take shape, and the external physical characteristics have assumed definite form, even though the embryo is only about one and one-fourth to two inches long. The organism, which becomes recognizably human at this point, is now called a *fetus*. The *fetal* period extends from about the eighth week until birth.

The entire term between conception and birth (normally about forty weeks) is called the *prenatal* period. Throughout the prenatal period the organism is enclosed in a sac attached at one side to the mother's uterus and filled with *amniotic fluid*, which equalizes the pressure on the embryo. The embryo gets nourishment through the *umbilical cord* from the *placenta*, an organ that develops for this purpose. There are no nerves connecting the mother and the unborn infant, nor is there any direct connection of blood vessels. Impure blood from the embryo or fetus is carried through vessels in the umbilical cord to the placenta, where it is exchanged for blood rich in oxygen and nutrients.

Techniques for studying fetal behavior. The first observable response of the embryo is the rhythmic beating of the primitive heart. At first, however, the heart response is purely muscular—that is, it occurs independently of the yet undifferentiated nervous system—and hence is not regarded as “adaptive behavior.” At what point, then, does the behavioral development of the human being begin? The generally accepted answer to this question is that the onset of behavior is established when a muscular response involving activity of the nervous system can first be elicited by stimulating a receptor (Carmichael, 1954). The nervous system reaches this stage of functional maturity about eight weeks after conception (the approximate beginning of the fetal stage of prenatal development).

Most of our knowledge of the capabilities of the fetus at various stages of development has come from studying infants born prematurely after having spent twenty-eight weeks (in rare cases as few as twenty-five weeks) in the uterus. It is now sometimes possible, however, to study the activities of much younger fetuses, when it is necessary to remove them

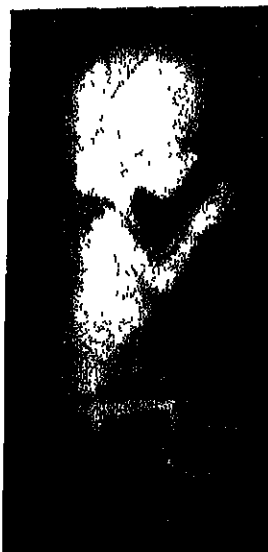
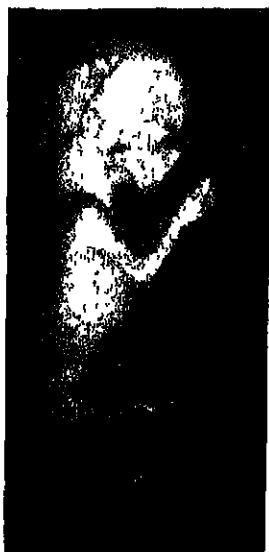
from the mother's body for medical reasons. One investigator has studied the responses of the very young fetus to touch stimuli by placing it in warm salt solution, with the placenta in a separate jar under a moist atmosphere of oxygen, and beginning his observations within two minutes after the fetus is removed from the uterus (Hooker, 1952).

A number of similar studies have done much to increase our knowledge of fetal behavior, but because premature delivery removes the fetus from its normal environment, it is always necessary to interpret the results of such observations with caution. When the fetus is in the uterus, it constantly receives oxygen and food materials from the mother. Premature delivery breaks this connection, and although investigators have simulated the prenatal environment as nearly as possible, it is never the same. Moreover, a general anesthetic is often used in such operations, making the fetus more sluggish than usual, less responsive to stimulation, and perhaps different in other ways as well. In many recent studies, however, it has been possible to use local anesthetics which do not appear to affect fetal behavior and in some instances even to observe the fetus while it was still in contact with the mother and receiving oxygen from her through the placenta.

Characteristics of fetal behavior. Studies of fetal behavior show two kinds of unlearned activities: (1) spontaneous movements and (2) externally stimulated movements.

Spontaneous movements. The human fetus makes many movements of the head, trunk, and limbs which are “spontaneous” in the sense that they occur when no external stimulus is applied. Particularly after the fourth month the mother can frequently feel the movements of her unborn child. Certainly the fetus does not remain in the same position during its many months of prenatal life. A few weeks before birth the fetus may grow very active. The head turns from side to side; the arms and legs draw in and thrust out. The movements are slow and irregular, involving several joints at once, and often several members of the body move at the same time. This sluggish, irregular, widespread movement is aptly described as *mass action* or as *irradiation* (diffusing outward).

Externally stimulated movements. As early as the eighth week of prenatal life, the fetus is responsive to touch stimuli on the nose, lips,



In this study movies were used to record fetal behavior. Repeated observation of the responses made possible more accurate analysis. In the first picture the sole of this fourteen-week-old fetus has just been stroked with a hair. The response is extreme flexion of the big toe, fanning of the other toes, flexion at the hip, and a slight backward movement of the foot, after which the fetus returns to normal posture.

and chin. Studies show that the area sensitive to stimulation gradually increases with the passage of time. By the thirteenth or fourteenth week the entire body is sensitive except for the top and back of the head, which do not respond to stimuli until after birth. When investigators stimulate the skin of the fetus—either by friction or by pressure, using hairs of varying stiffness—the responses are more jerky than are the slow spontaneous movements. At about fourteen weeks, however, fetal movements become less like the mechanical ones of a marionette and start to be more smoothly coordinated.

Most early fetal responses to specific stimuli show gross irradiation—the application of the stimulus to one part of the body elicits a *generalized* response of almost any body member. Response to stimulation of the nose or chin, for example, includes movements of the trunk and neck and extension of the arms. The series of pictures above shows such a generalized response. Not all fetal responses, however, are generalized; some are quite specific, especially during the final months of the prenatal period. A touch applied to the lip, for example, arouses the response of opening and closing the mouth—probably the beginning of the sucking response. Touching the eyelid makes it contract. A landmark is

reached at twenty-five weeks, when respiration can be carried on for as long as the fetus lives, usually about twenty-four hours. The eyes also open and close spontaneously. Grasping and sucking movements appear at about twenty-nine weeks. During the final period of prenatal life these reflexes continue to mature.

Although the anatomical structures of most of the special sensory mechanisms are sufficiently mature to function before birth, it is not known whether the fetus actually responds to many specific stimuli which happen to enter the mother's womb from outside. We do know that prematurely born infants are sensitive to temperature and taste but that their sensitivity to pain is weak. This delay in the development of the pain sense has been interpreted as a biological defense mechanism to protect the child during the birth process (Carmichael, 1951).

More question remains about whether the fetus can hear, in spite of the fluid in his ears.

In one study, tones were sounded through a speaker placed close to the mother's abdomen but not in contact with it, so that the sound waves had to pass through an air space and could not be conducted through physical contact with the mother's body. Mothers were warned so that they would not

tense their bodies when the tones were sounded. It was found that the rate of the fetal heartbeat increased sharply immediately after the sound stimulation, indicating that the fetus was sensitive to tonal stimulation although not necessarily that it was actually "hearing" the sounds (Bernard and Sontag, 1947).

Because observations of prenatal activity are necessarily indirect, our knowledge of fetal behavior is limited and incomplete. We do know that the human fetus, like any organism, makes spontaneous movements and also responds to stimulation. We know too that its behavior is far from adequate for adjusting to the complex outer world. This inadequacy is due not only to physical immaturity but also to lack of opportunity to learn. Adjustment means learning from the environment as well as making innate reactions.

[MATURATION DURING INFANCY]

After 280 days of "perfect comfort," with every need effortlessly satisfied, the human being suddenly finds himself propelled into a world where he must breathe to get his oxygen, suck to obtain his food, and cry vigorously to get a dry diaper. But the little *neonate*, as the newborn infant is called, is well equipped to take this appalling crisis in his stride. He is not quite so delicate as he may seem to the inexperienced mother who holds him in stiff, apprehensive arms when he is awake and checks often to see that he is still breathing when asleep. He is able to make most of his needs known, to understand a little of the world around him, and to make numerous movements on his own. Although he has much to learn and has far to mature physically, the infant begins immediately to make his adjustive reactions to the physical and social world about him.

Changes in skeletal and internal structure. At birth the neonate is by no means a miniature adult. The head is about one fourth of his total body length, whereas in an adult it is one seventh. He has a bulging abdomen and narrow shoulders (the reverse of adult proportions) and relatively short legs. His muscles are small and soft, and his bones are composed mostly of cartilage.

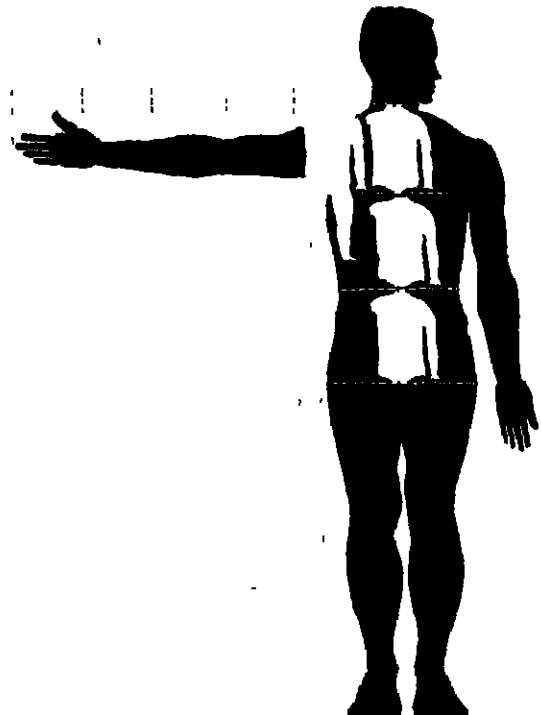
During the first years of life, while the infant's skeletal structure is growing toward adult proportions, the nervous system devel-

ops very rapidly, with the nerve cells increasing in size but not in number. Brain growth also is rapid—at birth the brain is one fourth the size of the adult brain, at nine months one half, and by the end of the second year three fourths adult size.

Sensory sensitivity. What is the newborn infant capable of seeing, hearing, and feeling? Though his sense organs are well developed, it is unlikely that he possesses true consciousness. Probably, as William James expressed it classically, "The baby, assailed by eyes, ears, nose, skin, and entrails at once, feels it all as one great blooming, buzzing confusion" (James, 1890). Though the infant cannot yet organize this confusion of sensations, he does experience many vivid perceptions, as various studies have indicated.

The sense of smell is well developed in the neonate. One investigator long ago found that infants refused to take the breast if it had

Infant and Adult Body Proportions



An infant is by no means a miniature adult. In growing to adulthood his proportions change greatly. His head doubles in size, his trunk triples, his arms and legs, respectively, reach four and five times their original length. (Adapted from Kahn, 1943)

been rubbed with an unpleasant smelling substance (Preyer, 1888). More recent investigators obtained a strong reaction when they stimulated infants with ammonia and acetic acid and a somewhat weaker reaction when they used cloves or valerian, a drug with a pungent smell. The infants were placed on a special platform equipped with a device for recording their movements so that activity before and after the stimulus could be compared (Pratt, Nelson, and Sun, 1930).

Taste is another well-developed sense in the newborn infant, who usually reacts with sucking movements to sweet or salty stimuli and with negative behavior to sour or bitter tastes.

Hearing seems to be less well developed at birth than the other senses, though there is much variation from child to child. Amniotic fluid, which often remains in the middle ear for a few days after birth, hampers hearing. Usually sometime between the third and seventh day the neonate reacts to ordinary noises, responding more vigorously to the rattling of paper or dishes than to a voice. After the fourth week, however, he responds more frequently to voices than to loud noises.

It is impossible for the neonate to see clearly at first because the retina has not reached its full development at birth. However, he responds to light and after about ten days of life can follow slowly moving objects with his eyes. Because his eye muscles are not well coordinated at first, he may occasionally look cross-eyed. There is some disagreement as to whether the young infant perceives color.

Sensations of touch, pressure, temperature, and pain are present at birth or shortly afterwards, with the face more sensitive than other parts of the body. The infant may refuse milk if the wrong temperature and also respond to external temperature sensations, reacting more strongly to cold than to heat in most cases. Sensitivity to pain is weak during the early days of life, being stronger on the face than elsewhere, as we might expect from the normal course of maturation from the head downward. Circumcisions may therefore be performed without anesthetic during the first two weeks.

Responsive behavior of the neonate. As early as the first day of life the neonate can yawn, hiccup, frown, lift his head slightly (this means that he can free his nose for breathing), make prancing movement with

his legs if supported at the armpits, and focus his eyes momentarily on a light (Hurlock, 1953). These accomplishments—along with the even more important sucking, swallowing, and other mouth movements involved in eating—are often called *general responses*, because they are responses to definite stimuli and in most cases involve the activity of rather large portions of the body. The infant also makes many specific, automatic responses known as *reflexes*. These involve only a small part of the body. One of the most readily observed is the grasping reflex, which the newborn makes in response to a light pressure on the palm of the hand. Other reflexes include the knee jerk, pupillary reaction to light, blinking, and sneezing.

All these responses, both general and specific, are really an outgrowth of mass activity involving the whole body. Mass activity, as we have seen, predominates during the fetal period, and even after birth nearly all responses to stimuli involve a large portion of the body. Because even his specific reflexes are accompanied by some total body activity, the infant expends about two and a half times as much energy in proportion to body weight as does the adult.

Differentiation of motor activity. From this vast amount of mass activity, specific movements are gradually differentiated. As in the case of the fetus, maturation in the neonate follows a definite sequence and also proceeds from the center outward and from the head downward. Thus the eye and mouth movements come under control first, then those of the head and neck, later those of the trunk and arms, still later those of the hands and lower trunk, and finally those of the pelvic region, legs, and fingers (Shirley, 1936). The rate at which new achievements are made is also faster for the upper regions of the body. Thus control of the eyes, head, neck, and arms is usually gained in rapid succession, with only a few days between each achievement. After the baby begins to sit alone, however, it may take weeks or months before new abilities involving the lower portions of the body—such as creeping, standing, and walking—are added to his repertoire.

It is important to remember that every child develops at his own individual rate. Some walk at the age of nine months; others wait until they are nearly twice that old. Though most babies succeed in "getting into every-

thing" quite efficiently by creeping about on all fours, many skip this method of locomotion altogether and pull themselves along on their stomachs or even hitch themselves backward. Wide variations also exist in the development of less conspicuous achievements than walking, so that it is useless to push children beyond their physical capacity to perform. As a case in point, the muscles involved in toilet training are among the last of which the child gains control; hence, it is futile to expect a child to be "trained" before he is about two years old (Ilg and Ames, 1955). Psychologists advise against too early or too rigid training because of the emotional reactions it may arouse in the child, who is not able to meet his parents' strict expectations. This often leads to emotional difficulties later.

Early social development. As he grows in size, makes more complex movements, and learns to coordinate his increasingly vivid perceptions, the infant develops a more and more active social life. The first year of life brings drastic changes in the way the baby spends his time. Just after he is born he spends from fifteen to twenty hours a day sleeping or dozing, but by the end of the first year he sleeps only about twelve hours and can sleep for much longer periods at one time than previously. Active manipulation of his environment, which might be called "experimentation," does not begin until he is about two months old but occupies about a third of his entire day by the time he is a year old, as may be seen from the diagrams on page 42 (Bühler, 1930).

Even from the moment of birth the infant is a social creature, influenced by the affection of his mother or others who care for him. Specific ways of dealing with babies, such as leisurely, "cuddly" feedings, gradual and late weaning, and patient, unhurried toilet training seem to be important to the formation of a healthy personality. Even more important, however, is the attitude of the parents toward the child, for, as we shall see (pages 57-62), this is responsible for most of the ideas and impressions the child forms about himself and his world.

Speech responses. Another important social development of infancy is the beginning of communication through speech. The infant begins to make language sounds during the first months after birth. While approximate vowel sounds are found in the babbling of



After being placed in the water by her grandmother, this two-month-old baby girl ducks her head, holds her breath, energetically works her legs and arms, and thus swims as far as ten feet. Every child matures at his own individual rate, and this infant shows an unusual level of muscular development in her precocious swimming ability.

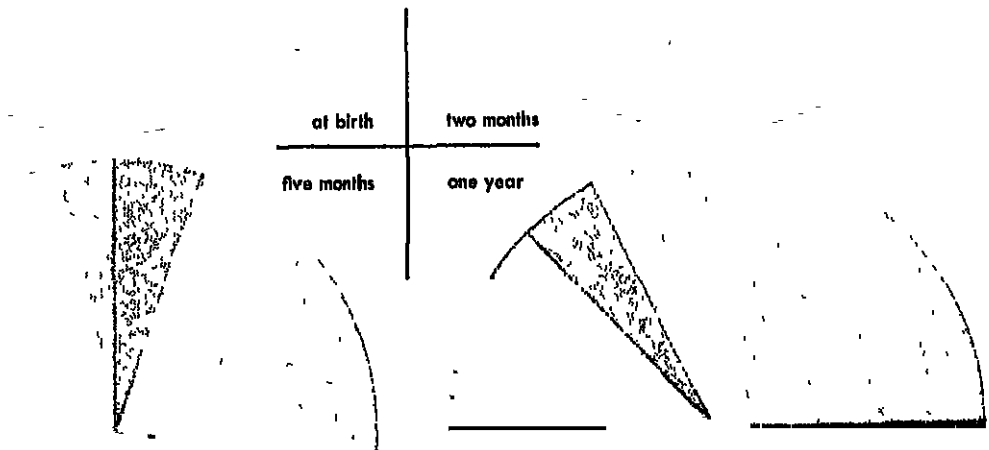
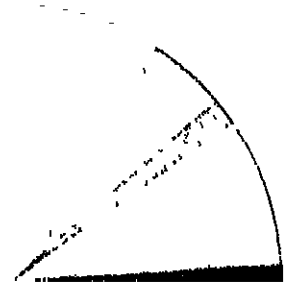
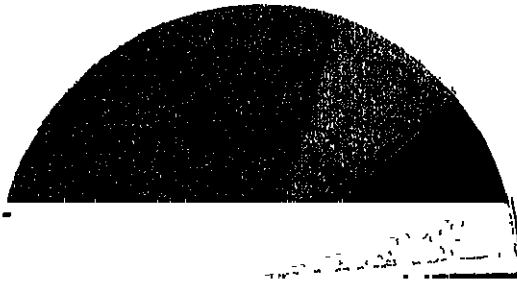
young infants, the only ones consistently used for the first two months are *e* as in *bet*, *i* as in *bit*, and *u* as in *but*. For the most part the neonate uses vowels that are produced at the front of the mouth with the tongue in a relaxed position. It is much more difficult to produce "back vowels," such as *oo* and *ah*, which require drawing the tip of the tongue away from the teeth into the back part of the mouth. The percentage of utterances of back vowels increases as the child matures. When he is about two and a half, the relative proportions of all vowel sounds used in his speech are about the same as found in adult speech (Irwin, 1948).

Many consonant sounds, particularly *m*, *n*, *g*, *h*, *w*, and *r*, are also noticeable in the infant's babbling. Recent research suggests that there may be a relationship between the number of different kinds of consonants uttered during infancy and later intellectual status (Catalano and McCarthy, 1954). Some consonant sounds, however, are always later than others in developing. Until the baby has teeth, for example, it is impossible for him to use the *fricatives* (such as *z* and *s*); nor can he sound the *explosives* (such as *b* and *p*) until his muscles have become strong enough to supply the tension needed for making these sounds.

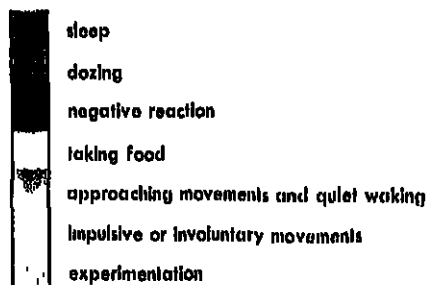
The babbling and chattering of the young infant is an extremely important process in speech learning. By manipulating sounds and syllables the infant is exercising his lips,

tongue, and breathing in various combinations and is developing his vocal motor skill. The speech sounds used by an infant include those found in all languages, but as a child contin-

Typical Activity Cycles of Infants



These diagrams show how the infant develops socially during his first year. Notice how the proportion of time spent in the various activities changes. At birth, waking activities other than those shown on the diagram occupy so little time that they have not been separately designated. Experimentation, however, does not even begin until about the second month. Notice the different ways the infant spends his nonsleeping hours at five months and at a year. (Adapted from Bühler, 1930)



ues to develop through maturation and learning, those sounds not used in his particular language drop out.

Until recently studies in this field have been handicapped by the fact that experimenters have had to rely on their subjective impressions of infant speech sounds. The development of new techniques such as the use of *sound spectrograms* (sound pictures) now permits more objective analysis (Lynip, 1951). The results of future studies may eventually require that some of the conclusions presented here be modified.

MATURATION DURING CHILDHOOD AND ADOLESCENCE

Although the newborn infant is sensitive and reactive to his environment, he is largely helpless in coping with it. This is partly because he lacks knowledge of his new environment, but no amount of learning will enable him to make effective adjustments as long as he remains so physically immature. As we have noted, adequate adjustive behavior is always dependent upon the maturation of underlying muscular, skeletal, glandular, and nervous structures. As the individual grows older his height and weight increase, his entire nervous system becomes more complex, his muscles become stronger and more able to respond, and his ductless gland system undergoes important changes. The behavioral development of an individual into a capable adult is closely associated with these maturational processes.

Physical growth. The most rapid period of human growth occurs during the prenatal period, when the organism grows from a single cell—smaller than a droplet of water—into an infant weighing normally between six and eight pounds. The *rate* of growth continues to be rapid during the first year but then slows down. It is slowest during the middle school years and then takes a sudden spurt near the start of adolescence. The difference between the growth rates of boys and girls is highlighted in the chart (page 44) showing the rates of growth for a particular boy and girl.

Physical growth during childhood and adolescence also brings about changes in body proportions. By the time the individual has reached physical maturity, the proportionate size of the head is much smaller than during infancy, whereas the trunk and limbs are pro-

portionally longer. These changes greatly increase the grace and efficiency of the individual's body movements as he grows toward maturity.

Maturation in the nervous system. The development of behavior depends directly upon the maturation of the nervous system—the intricate chains of nerve cells which form the neural patterns underlying all adjustive responses. As the child develops, improvements in his ability to make adequate adjustments are closely associated with two important changes in his nervous system: (1) an increase in the size of his brain and (2) an increase in the complexity of the neural patterns connecting receptors and effectors. (See pages 484-487 for a fuller discussion.)

Increased brain size. During the first few years of childhood, increases in the size of the brain give a rough indication of its increased capacity to function. By the time of birth the individual already has his full number of brain cells, but many of these cells are still not sufficiently mature to function. This is particularly true of those in the *cerebral cortex*, the part of the brain associated with conscious experience and higher mental processes. The behavior of the infant during the first few weeks of life, therefore, is largely confined to reflex responses and mass involuntary movements that operate mainly through the spinal cord and certain lower brain centers which are already fairly well developed.

During infancy the brain grows at a faster rate than most other body parts. From about the fifth to the eighteenth month after birth, the *cerebellum*—the part of the brain that controls the coordination of movements necessary for balance in sitting, walking, and manipulation—grows very rapidly in relation to the other parts of the brain. This is the period when the infant learns to sit up, crawl, and begins to walk—activities all heavily dependent upon coordination.

By the time the child enters school his brain has nearly reached its adult size, although its functional capacity will continue to increase for many years. Several attempts have been made to establish a relationship between brain size and intelligence, but except in cases where the number of brain cells is extremely deficient, investigators have been unable to find any relationship.

Development of neural patterns. The maturation of patterns in the nervous system can

be likened to the "branching out" of a growing tree. At first there are only a few main nerve fibers, but as the organism develops, these fibers send out branches which "migrate" away from the "trunk" and establish connections with similar branches growing from neighboring neurons. In this manner a single nerve cell may make contact with hundreds of other neurons, and an intricate network of neural interconnections is established.

During the process of neural maturation a great number of alternate pathways are laid down, thus making possible a variety of responses to a given stimulus. Such neural associations, established by maturation and potentially capable of eliciting particular types of responses, are called *structural* connections. Whether they ever become *functional*—that is, whether they will actually participate in the transmission of a nerve impulse between receptor and effector—depends upon a variety of factors:

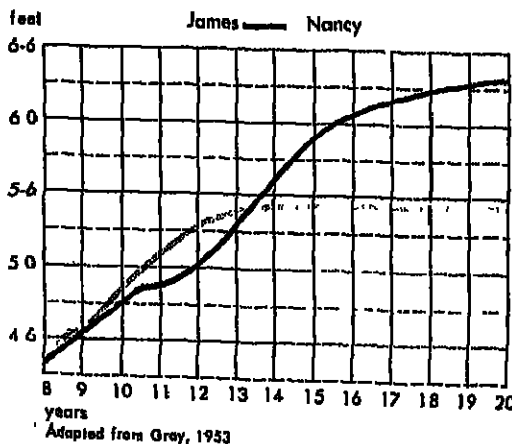
1. Receptors, which activate the nervous system, normally respond only to a specific kind of stimulus. Unless the appropriate stimulus is administered with sufficient intensity, the neural pattern will not function. Thus, for example, the unborn child's visual structures may be ready and waiting to function, but the fetus actually sees nothing because there are no light stimuli in the womb.
2. Some of the structural connections between neurons are not biologically capable of functioning. Many impulses entering the nervous system apparently "get nowhere" because somewhere along the line a connection fails to function.

3. Neural connections which have been ineffective, though complete, may become functional through experience and learning. Just what biological processes occur in the nervous system during learning is still largely a matter of conjecture.

In short, the complex network of neural interconnections underlying all behavior is laid down by the process of *maturation*, but *experience* and *learning* change these basic patterns and determine whether they will be used. Although the richness of potential connections increases as maturation proceeds, opportunity still determines the extent to which they become functional in eliciting behavior.

Muscular development. Often a child fails to perform some pattern of behavior which will come easily at a later age, because he lacks sufficient muscle maturity. Although the infant has his total number of muscle cells at birth, they grow in size and strength through maturation and exercise. The neural patterns underlying walking behavior are sufficiently developed shortly after birth to enable the infant to walk, but most babies cannot walk until their second year because their muscles are too weak to support their bodies.

Muscular development is slow throughout early childhood. Studies indicate that a person still has to gain about four fifths of his total strength after the age of six, although he has already attained two thirds of his adult height by that time (Jones, 1949). Muscular growth is most rapid during adolescence, when the individual begins to "fill out" and approaches adult height and proportions. In tests of pure muscular strength such as hand grip, both



Rates of Growth

The graph at the left shows the rates of growth for a particular boy and girl from ages eight to twenty. The picograph at the right shows average gains in height and physical maturity of boys and girls at ages nine, thirteen, and fifteen. At nine boys are slightly taller than girls, but neither has begun to mature. Because girls enter the adolescent phase of rapid growth earlier than boys do, they are taller at twelve than boys, and their hips have widened. At fifteen, however, the boys are again taller than the girls. Their physical maturity is shown by their broad shoulders as compared to their narrow hips. They will continue to grow rapidly for four or five more years, while the girls have almost attained their full height.

boys and girls show steady increases throughout adolescence, although boys display more marked increases and continue to develop over a longer period of time than girls (Jones, 1949).

Exercise as well as maturation is needed for developing muscle strength. In the performance of athletic skills such as the fifty-yard dash and broad jump, for instance, boys increase regularly during adolescence, whereas girls level off about the age of thirteen and then actually decline (Espenschade, 1940). One explanation for this is the fact that such activities are not considered feminine in our culture. Girls are reluctant to engage in practice which develops these muscular skills, whereas adolescent boys place high value on athletic prowess.

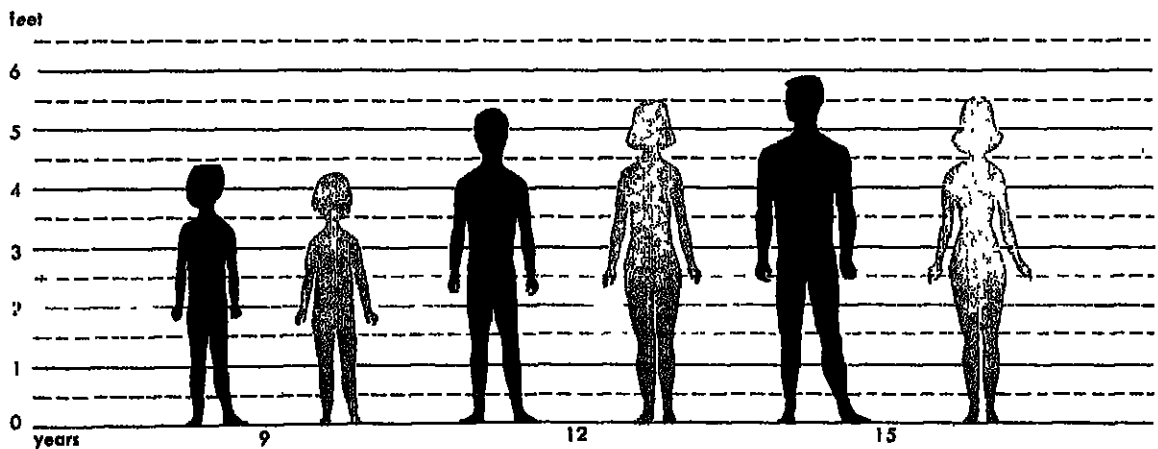
How the endocrines guide development. One of the most important groups of biological structures to influence the course of development is the system of ductless glands, or *endocrines*. These glands, which are well supplied with blood vessels but have no ducts through which to channel the substances they produce, pass their secretions directly into the bloodstream. The chemical substances secreted by the endocrines are called *hormones* and greatly affect the course of bodily development and functioning.

The activity of the endocrines is *regulatory* in nature. Hormones do not *cause* growth, but they do control the *rates* of certain bodily processes associated with maturation. They serve to speed up and slow down, start and stop, various physiological activities. The change of voice in the adolescent boy, for

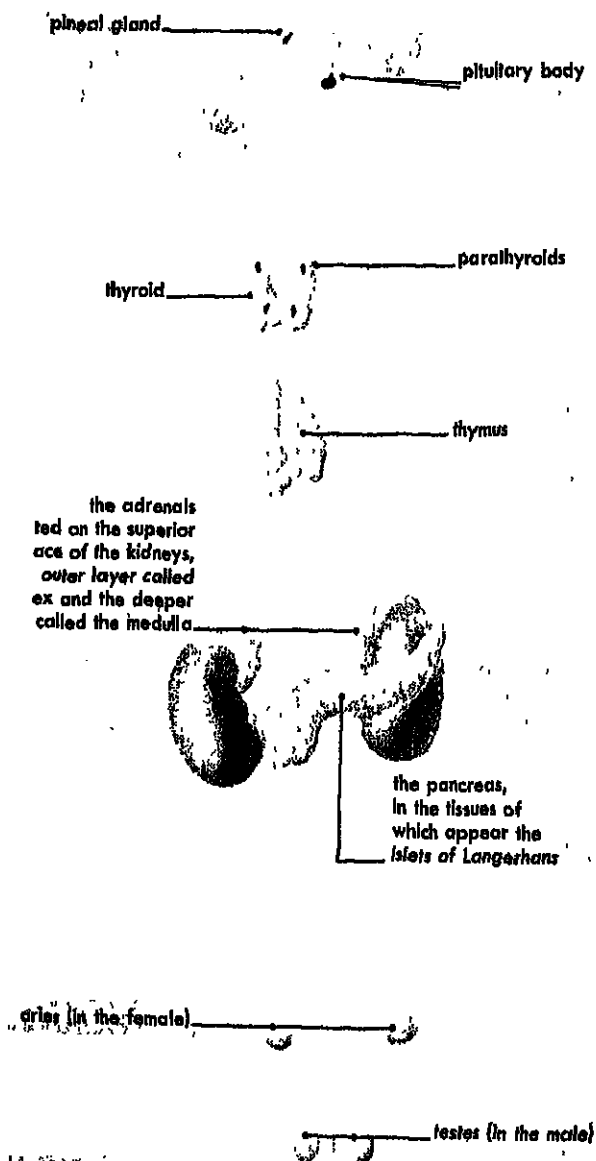
example, is associated with the activity of certain glands which begin actively to secrete their hormones at the time of adolescence. Whether an individual reaches physical maturity early or late depends on the combined action of several glands in the endocrine system.

An important way in which hormones influence development is through their controlling effect on an individual's *metabolism*—the constant chemical changes taking place in all living tissues by which energy is provided to carry on the life processes. The growth of bones, muscles, and nervous tissue results from metabolic processes involving endocrine activity. When there is more than a normal amount of calcium in the blood, for example, certain endocrine glands secrete hormones that help the body tissues assimilate the calcium, which is essential to normal bone development. Similarly, if there is an oversupply of sugar in the bloodstream, certain endocrine structures release a flow of the hormone *insulin*, which helps the body metabolize the sugar and return the blood to its normal chemical state. This tendency of the body to maintain chemical equilibrium is known as *homeostasis* and involves activity of the nervous system and other physiological mechanisms as well as the endocrines.

In helping to maintain equilibrium, the various endocrine glands work together in complex coordination. If one gland is functioning too slowly, another gland may release a hormone to stimulate its action; if one endocrine is overactive, another may secrete a hormone to slow it down. Damage or removal



Adapted from Beck, 1949



The Endocrine System

Above are shown the locations of various ductless glands. The PITUITARY BODY produces the growth hormone and the "middle man" hormones. The THYROID affects bodily metabolism, growth, and the development of intelligence. The PARATHYROIDS influence calcium and phosphorus metabolism. The ADRENAL MEDULLA produces adrenaline and noradrenaline, both important in emotion. The ADRENAL CORTIX affects general body activity and secondary sex characteristics and plays a part in reaction to prolonged stress. The GONADS are vital to sexual development, sexual drive, and reproduction. The OVARIES (in the female) produce estrogens and progesterone. The TESTES (in the male) produce androgens. The ISLETS OF LANGERHANS in the PANCREAS produce insulin, which controls the sugar level in the blood. The functions of the PINEAL GLAND and the THYMUS are

of one gland in the endocrine system may disrupt the functioning of the entire system. There are indications that the master control center for the endocrine system may lie in the *hypothalamus* (page 503), a lower brain center known to be concerned with the control of many bodily functions (Talbot *et al.*, 1952).

Endocrinology is a comparatively new study in the field of physiology, and the functions of the ductless glands are still only partially understood. We do not have a full list of the hormones, nor do we know all the organs that produce them. There has been recent evidence to indicate that even the nerve cells of the hypothalamus may secrete certain hormones (Zuckerman, 1957).

Despite the many gaps in our knowledge about the mechanisms of the endocrine system, there is abundant evidence that the endocrines play an important role in human development and adjustment. Those which seem to have the greatest influence on the course of human maturation are the *pituitary*, the *thyroids*, the *adrenals*, and the *gonads*.

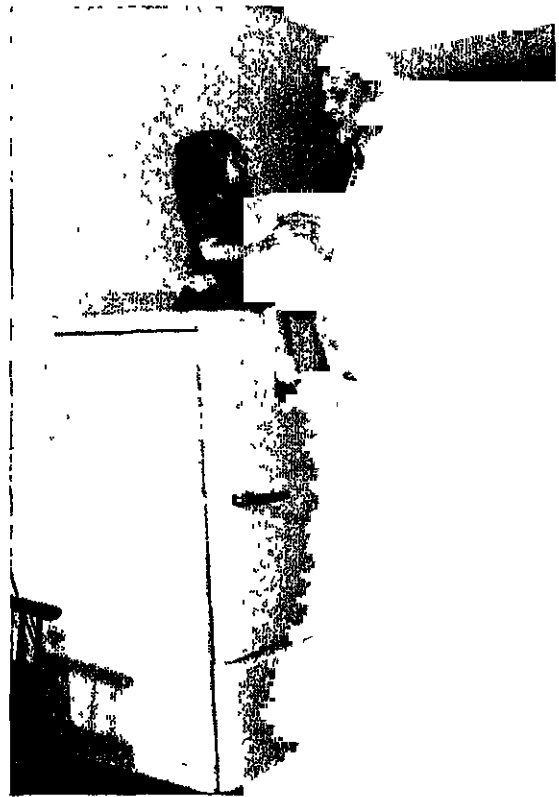
The pituitary. The most important endocrine gland associated directly with physical development is the *pituitary*, a small structure attached to the underside of the brain and located right in the center of the head. The pituitary secretes a number of different hormones which perform various functions concerned with growth and maintenance. Particularly vital to normal bodily development during childhood is the *pituitary growth hormone*, which controls the growth of the skeleton, muscles, and various internal organs (Li and Evans, 1949). Improper functioning of the pituitary gland in producing this hormone may result in such abnormal conditions as *dwarfism*, *giantism*, or *acromegaly*, illustrated on pages 47 and 48.

A deficiency of the pituitary growth hormone early in life causes an underdevelopment of the bones, resulting in *dwarfism*. An early excess of this hormone produces *giantism*. During the period of oversecretion, a person can reach the height of as much as nine feet; then secretion declines, usually leaving the individual strong in appearance but actually with much weaker muscles and less sexual appetite than the normal individual. Fortunately *giantism* can be prevented by surgical removal of some of the excess glandular substance if the condition is recognized early enough.

Like *giantism*, *acromegaly* results from an



Undersecretion of the pituitary growth hormone early in life causes dwarfism (above); oversecretion results in gigantism (right). The most striking difference is in the length of the limbs.



oversecretion of the pituitary growth hormone. But unlike gigantism, it results from oversecretion starting later in life which produces an overgrowth of only portions of the skeleton, instead of the whole body. Characteristic of acromegaly are enlarged hands, arms lengthened until the fingers reach knee level, heavy jawbone, greatly expanded chest, and bent back. This condition is often accompanied by various symptoms of personality disorder. They may arise in part from the individual's feeling of inferiority about his body deformity, but they also are a direct result of the hormone imbalance, which disrupts the functioning of the nervous system.

The pituitary also produces a variety of "middle man" hormones which act directly upon other endocrine glands—most notably the thyroids, the sex glands, and the adrenal cortex—to stimulate their functioning. The interaction between the pituitary hormone *corticotrophin* (ACTH) and the secretions of the adrenal cortex have been shown to be an important factor in rheumatoid arthritis and other physiological disorders. A theoretical explanation of the relationship between

endocrine function and disease—the concept of the *general-adaptation-syndrome*—will be discussed in Chapter 6.

A multitude of factors seem to control the secretion of the pituitary's "middle man" hormones. Many of them are not produced in quantity until the onset of adolescence, when they begin to prompt activity in those glands controlling the development of mature sexual characteristics. Failure of the pituitary to produce these "middle man" hormones at the proper time can delay sexual maturation, whereas early release of the "middle men" has been known in extreme cases to cause the appearance of mature sexual characteristics even in infants.

The thyroids. Located in the neck at either side of the "Adam's apple" are the thyroid glands. Operating in close conjunction with the pituitary, the thyroids affect body metabolism and help control the rate of physical growth. Like the pituitary, the thyroids also appear to secrete hormones which stimulate the sex glands, although this function is not well understood. Thyroid secretions exercise a very definite influence upon the structure and



Maurice Tillet, a French wrestler, is shown grinning happily after getting his United States citizenship papers. He became aware of acromegaly in his late teens. Notice particularly his long jaw and enlarged hands. Although he graduated from college and attended law school, he capitalized on his unusual appearance and great strength to find fame in wrestling as "The Angel."

function of the nervous system especially in the development of intelligence.

Extreme thyroid deficiency during infancy or early childhood results in a condition known as *cretinism*. The primary symptom of this disorder is retarded development, particularly of the skeletal and nervous system, resulting in a peculiar type of dwarfism accompanied generally by low-grade intelligence. This intellectual retardation appears to stem mainly from poor development of nervous tissue, particularly in the brain. When extreme thyroid deficiency occurs during the first two years after birth, during the time when the cortex of the brain is normally growing very rapidly, adverse effects on the child's intelligence are particularly striking. Only about a fourth of such children ever achieve normal intelligence, although proper hormone treatment nearly always produces some improvement. With treatment, children who are over two when this disorder occurs develop normal intelligence in about 90 per cent of the cases.

The adrenal glands. Located at the upper end of the kidneys are the two adrenal glands, each consisting of two parts: an inner core (the adrenal medulla) and an outer layer

(the adrenal cortex). The adrenal medulla is directly controlled by the nervous system, which stimulates the gland to secrete its hormones, *adrenaline* and *noradrenaline*, when the individual is under strong emotion. The manner in which the adrenal glands help the individual adjust to emergency situations will be discussed in Chapter 6.

More significant in terms of development is the function of the *adrenal cortex* in producing several different hormones that influence maturation. Of major importance are the *adrenal androgens*, which regulate the development of certain adult sexual characteristics, particularly those associated with masculinity. These hormones, which the adrenal cortex normally begins to secrete just before adolescence, are partly responsible for adult hair distribution and lowering of the voice—changes that occur in both sexes, although they are more marked in boys. Adrenal hormones also contribute to the appearance of pimples, frequently an embarrassing complaint of adolescents. In producing such changes the adrenal hormones work in conjunction with other androgens produced by the sex glands, which also begin functioning actively at the time of adolescence.

Overactivity of the adrenal cortex produces both heightened body activity and an accentuation of masculine characteristics, such as growth of beard and deepening of the voice. This condition, known as *virilism*, may occur in either sex. The "bearded lady" of the circus is probably the victim of a too active adrenal cortex. When the adrenal cortex becomes active in early childhood, physical changes may occur which give the appearance of sexual maturity, although the reproductive glands themselves do not generally become active unless the real trouble is a malfunctioning of the pituitary, which can stimulate activity in *both* the adrenals and the sex glands.

The gonads. The sex glands, or gonads, begin to influence development significantly at the onset of adolescence—by definition, the period of life when the process of sexual maturation occurs. In both sexes the gonads have a dual purpose: (1) the secretion of sex hormones that influence bodily development and behavior and (2) the production of gametes (sperms or eggs). These functions are performed in males by the *testes* and in females by the *ovaries*.

Although the gonads secrete small amounts



A puffy face, wide-set eyes, protruding abdomen, and listlessness marked the baby girl shown at left as a cretin when she was brought to a hospital at the age of two and a half months. After receiving prompt hormone treatment, she became the alert and lively fifteen-month-old at right.

of hormones into the bloodstream during childhood, at the beginning of adolescence (usually about ten or eleven for girls and thirteen or fourteen for boys) the gonads become very active and increase their output of hormones enormously. The gonads do not normally begin producing mature sperms or eggs, however, until after two to four more years. Meanwhile, before the onset of *puberty* (the stage of development when reproduction first becomes possible), the sex hormones are producing bodily changes that prepare the individual for parenthood. After puberty, adolescence continues for a few more years until the person has reached his full strength and stature.

The *male* sex hormones produced by the testes are called *testicular androgens*. In many respects these are similar to the androgens secreted by the adrenal cortex, but the testicular hormones normally have much the greater effect. Although they do not work alone, the testes are the major glands under-

lying the development of masculine characteristics during adolescence. One of the earliest signs that the testes have become active is an increase in muscular and skeletal growth. (The fact that boys eventually become taller and stronger than girls can partly be attributed to the work of their hormones.) In addition to guiding the maturation of the male reproductive organs, the testicular androgens are also responsible for the appearance of sexual desire and for the energetic and aggressive behavior common among adolescent boys.

Lack of male hormones, due to injury or surgical removal of the testes (*castration*), can produce striking changes in an individual's development and behavior. Males who are castrated early in life develop into timid persons, lacking initiative, disinterested in romantic love, and lacking in sexual appetite. They even retain the high voice of childhood. Most of these symptoms can be dispelled by the artificial administration of male sex hor-



The precocious comb and wattles of the eighteen-day-old chick at left were caused by an injection of the male hormone testosterone, given by Hans Selye in an experiment at the University of Montreal. The picture at right shows the normal development of a chick at eighteen days.

mones, although castrated males have permanently lost their capacity to reproduce.

In the *female* the ovaries produce two main types of hormones: the *estrogens*, which promote growth in the reproductive organs and other body parts important to childbearing and motherhood; and *progestin*, which produces changes in uterus tissues so that they can support fetal life. The exact age at which adolescence commences in females is often difficult to observe since the first effect of increased ovarian activity is the growth of the internal reproductive organs. The first obvious indicators of adolescence are the budding of breasts and the appearance of hair in the genital region. At about the same time, changes in skeletal proportions begin, particularly widening in the area of the hips. Between the ages of twelve and fourteen most girls reach *menarche*, the stage at which menstruation first occurs. All of these changes are due mainly to the activity of the estrogens.

Even when menstruation begins, a girl has not reached puberty in a technical sense—that is, several months are normally required before she can become pregnant. During the period between menarche and puberty the second female hormone (progestin) becomes active and produces changes in the uterus which enable it to support and nourish a fetus.

Once this is accomplished, growth rapidly ceases and adolescence comes to an end. Boys, on the other hand, generally continue growing for a few years after they reach puberty.

All the maturational changes influenced by the endocrine system are primarily the result of hereditary factors working over a period of time. The rate and extent of physical development are mainly determined by the genes, which presumably act through the nervous system to stimulate and control the endocrines. Thus the role that heredity plays in human development is expressed in the way the individual learns to make adjustive responses. Heredity sets a limit on a person's capacity to learn, but environment largely determines the extent to which the individual will fall short of that limit.

ENVIRONMENT AND LEARNING

Although we speak of the effects of maturation upon the development of human behavior, it is incorrect to say that behavior

itself matures. Strictly speaking maturation refers only to the organism's biological structures, whereas behavior implies an *interaction* between the organism and elements in its environment. As we have seen, the complexity of behavior is limited both by maturation and by the extent to which the environment provides stimulation.

THE "INSTINCT" CONTROVERSY

The question of whether human beings possess inherited "instincts" which govern their behavior was for years the subject of a long, futile controversy. Psychologists, educators, and philosophers have all argued the meaning of the concept of "instinct," aligning themselves in opposing camps of opinion. The "yes" camp has listed dozens of human "instincts" ranging from the "maternal" to the "cleanliness" to the "war" instincts. Members of the "no" camp, on the other hand, have denied the validity of the whole concept of human instincts.

Although complete agreement is still lacking, the instinct controversy today is mostly a matter of historical interest to psychologists. As with most controversies, the root of the difficulty was a failure to define terms adequately. In fact, for a long time many psychologists were unwilling to use the term "instinct" at all because there was no general agreement as to just what it meant. More recently, however, the term has been redefined, and it is now generally agreed that *an instinctive behavior pattern is one whose underlying biological pattern has been produced by maturation rather than by learning*. It is inborn—a product of heredity—although it may not appear until months or even years after birth. It is found in all members of a species, regardless of differences in their environment. From the moment that the underlying biological pattern is mature, a behavior pattern that is truly instinctive will appear "full-blown" *upon the first occasion that adequate stimulus is presented, without previous opportunity to learn*. The last part of the definition is what distinguishes it from the earlier concept, which defined instincts as operating without reference to environmental opportunity or stimulation.

We have already seen a few examples of instinctive behavior in our discussion of the reflex activities of the neonate, such as his

feeding responses. Carmichael's classic experiment on the development of swimming in tadpoles strikingly illustrates the role of maturation in certain behavior patterns of animals.

Frog eggs were placed in a solution of chloroform, an anesthetic which stops all responses to stimuli but does not interfere with normal growth. These animals could develop through maturation but not through learning, since stimulation is presumed to be essential to learning. They were in effect developing in a psychological vacuum.

Tadpoles in a control group were kept under the same conditions of temperature and light as the experimental group but were allowed to swim freely in pure water. Thus they were exposed to the joint influences of maturation and stimulation.

When the control animals—those exposed to both maturation and stimulation—had reached the stage of free swimming, the experimental animals were removed from their anesthetic solution and placed in pure water. Though they had had no chance to learn, they swam just as well as the normal ones (when accurate allowance was made for the time required to "thaw out" from the anesthetic). Thus we can conclude that the ability of tadpoles to make swimming movements is one that develops through maturation in the absence of learning prior to the test period (Carmichael, 1926).

Another experimenter studied the role of maturation in the development of sexual behavior patterns in rats.

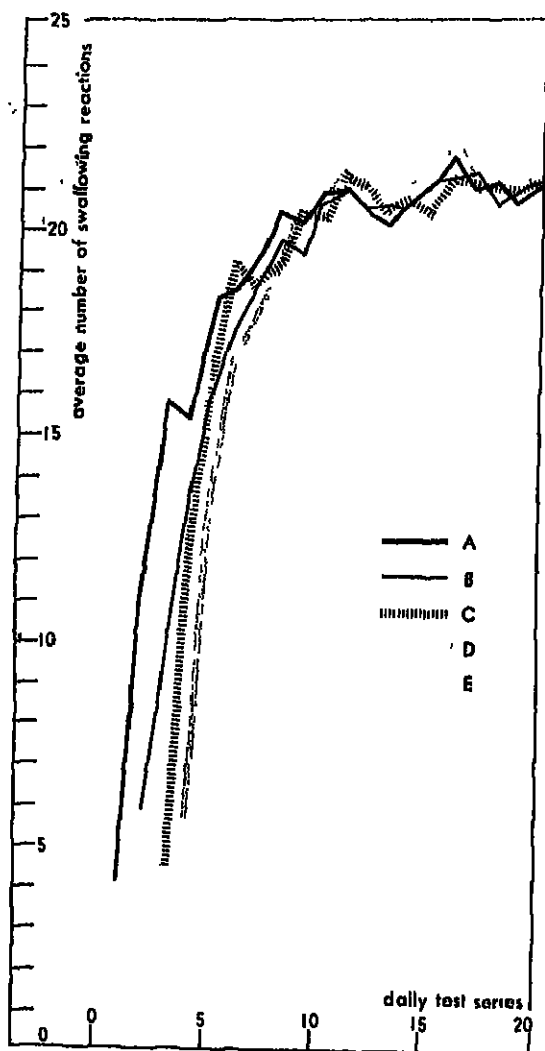
Male rats were reared in isolation until the age of sexual maturity. Until the day they were to be tested for the presence of instinctive sexual behavior, they had never seen another animal. At the age at which normal rats have reached full sexual maturity, as indicated by their engaging in mating behavior, the males reared in isolation were placed in cages with sexually receptive females which had had previous sexual experience. Almost immediately the isolated males engaged the females in typical mating behavior. The observer did not notice any important differences between the behavior of the normal and the isolated rats (Stone, 1922).

These experiments strikingly verify the fact that, *in animals*, maturation can cause behavior patterns to emerge in practically complete utility when there has been little or no previous stimulation or learning. These behavior patterns may truly be called "instincts."

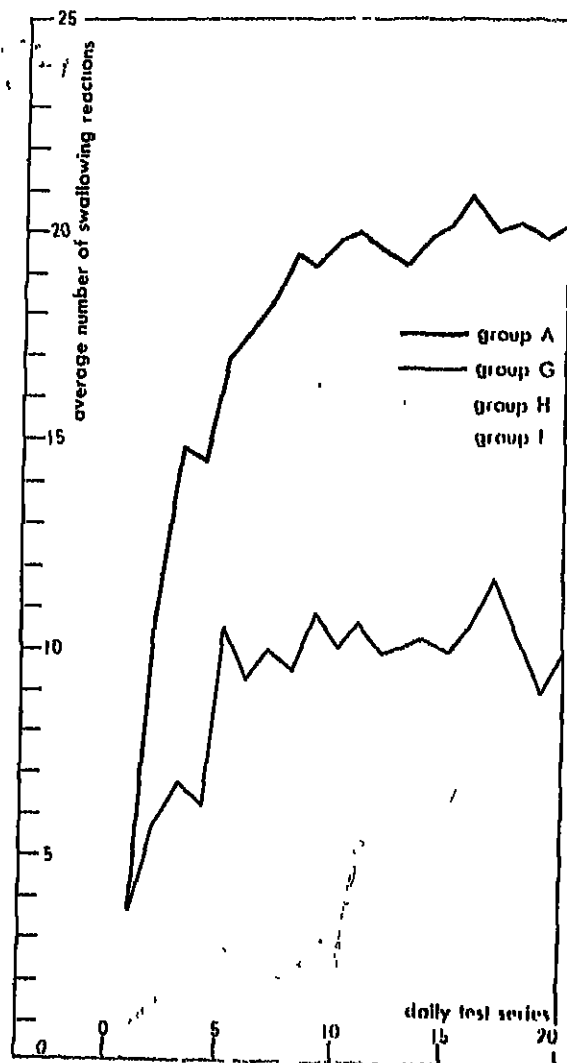
In man, however, instinctive behavior is very rare. The great difference lies in the superiority of man's nervous system, particularly his brain, which affords him a far greater biolog-

ical opportunity to profit from environmental stimulation. Whatever instincts may be present in man are so rapidly overlaid by the effects of learning that it is highly doubtful

Maturation and Practice Under Varying Conditions



In one experiment on so-called "instinctive" behavior, the experimenter divided 202 chicks into eight groups. The first five groups were kept in darkness for one, two, three, four, and five days respectively, after which they were brought into the light and allowed to practice pecking as much as they liked. As we can see from the above curves (left), Group E, confined for five days, reached the same proficiency of pecking after only seven days' practice as Group A, confined only one day but released at a less mature level of development. This looks like a simple case of more mature individuals needing less practice. However, one factor had been



left uncontrolled—the amount of practice after removal from the dark. Accordingly, three more groups—F, G, and H—were given varying amounts of practice during the daily practice periods; they were kept in darkness the rest of the time. Group F had twelve pecks per day; Group G, twenty-five pecks per day; Group H, twelve pecks per day for the first ten days, then twenty-five pecks per day. All started after one day of confinement and thus were comparable to Group A. The curves above (right) show that extensive practice was needed to develop proficiency even in this apparently "instinctive" behavior. Maturation is not the whole answer (Cruze, 1935).

whether the human adult exhibits any purely instinctive behavior.

Learning, of course, affects various behavior patterns in varying degrees. Some behavior is almost entirely the result of learning, while other response systems develop almost entirely through maturation. Particular behavior patterns fall somewhere in a continuum between pure instinct and pure learning, depending upon the degree to which learning acts with maturation in their development.

DEVELOPMENT LIMITED BY ENVIRONMENT

No organism can exist in a vacuum, for some external stimulation is necessary for the maintenance of life—food must be taken in, air must be breathed, body temperature must be maintained. Environments may differ greatly, however, in opportunities for learning.

Restricted environment in early childhood. Various studies have been made to determine how well infant skills would develop without adult encouragement and example.

One well-known study was made by Spitz of the overall development of a group of children who were given over to institutional care during infancy. It was concluded that the absence of normal maternal care—by either the biological mother or an adequate mother substitute—often retards an infant's physical as well as emotional development. Of those children whom the investigator was able to trace at the end of two years, an unusual percentage had died and most of the others were significantly retarded in such characteristics as height, weight, physical skills like standing and walking, and speech. According to Spitz' report, the significant factor in retarding development was that the institutionalized children received only one twelfth to one fifteenth as much "maternal" attention as do most children in a normal environment (Spitz, 1946).

This study unfortunately does not go into detail about the actual amount and kind of contact the infants had with the institutional personnel responsible for their care. Spitz has also been criticized for inconsistencies in his descriptions of the children's health and care and for his failure to equate his subjects as to heredity and socio-economic background (Pinneau, 1955). Such criticisms of this investigator's research methods have made his findings highly controversial.

There have been other better controlled studies, however, which seem to support many of Spitz' conclusions. One such study dealt with adolescents who had spent their infancy in institutions.

The subjects of this investigation were fifteen adolescents, aged ten to fourteen, who had been placed under institutional care at about the age of four months and had remained in institutions for about three years. They had then been placed in foster homes. These children were equated as to age and sex with members of a control group. The controls were also foster children, but they had gone directly to the foster homes from their own homes, while still under two years of age, and had spent no time under institutional care. The foster homes were of similar economic and cultural status in both groups, and the children had made about equal adjustments to the homes.

When the adolescents who had spent their infancy in institutions were compared with those who had always lived in homes, striking differences were noted. On intelligence tests 100 per cent of the institutionalized group made below average total scores, as compared to only 40 per cent of the family children. Important personality differences were also noted. The institutionalized group showed meager, undifferentiated personalities, characterized by apathy and lack of ambition. They were less responsive to approval, less thoughtful in problem solving, less mature socially, less stimulated by competition, and less capable of sustained effort. In spite of having spent several years in a family environment, they were retarded in language and speech development. Most of them were unable to form satisfying relationships with other people and thus suffered from feelings of personal insecurity (Goldfarb, 1943).

The deprivations these adolescents had experienced during infancy apparently left lasting effects that were not overcome by the experience of relatively normal home life in later years.

Occasionally children have been reared under conditions of such extreme isolation that they have had almost no opportunity to learn. Such cases, of which two are described below, illustrate in striking fashion how a sufficiently barren environment will result in an impoverished repertoire of behavior patterns—that is, in failure of the individual to achieve the potential level of development set down by his heredity.

Consider the case of Anna (Davis, 1947).

Anna was the second illegitimate child born to her mother, a feeble-minded girl whose behavior at the age of thirty-two was about equal to that of a normal eight-year-old. Her grandfather was so angry that he did not want the child in the house. Anna spent eight weeks in a children's home and the rest of her early infancy in various private homes but was returned, as a last resort, to the mother's home at the age of five and a half months. The mother kept Anna on the second floor in an attic-like room so as not to offend the grandfather. The child was alone nearly all the time and received barely enough care to keep her alive, being fed almost nothing but cow's milk and seldom having her clothing changed.

When she was finally found at the age of almost six, she could not walk or talk. After two years in an enriched environment Anna was able to walk, understand simple commands, feed herself, achieve some neatness, and remember people, but she still did not talk. Her mental age seemed to be that of an infant something over a year old.

Anna died of jaundice at the age of about ten and a half. The last report before her death (written from the private school where she was placed) stated that she could follow directions, string beads, identify a few colors, build with blocks, and differentiate between attractive and unattractive pictures. She loved dolls and had a good sense of rhythm. Though she talked mainly in phrases, she would repeat words and try to carry on a conversation. She kept herself very clean. She was easily excited but had a pleasant disposition and tried to help other children. An earlier report from the school included a statement that she was feeble-minded, "probably congenital in type."

Although Anna's achievements are striking when compared with her state when found, they still do not represent normal behavior for a child of her age. The author states, "One conclusion therefore seems safe, namely that her isolation prevented a considerable amount of mental development that was undoubtedly part of her capacity." Anna's isolation may not have been the only major factor responsible for her retardation, however. One fact which leads us to suspect that she may have been congenitally defective is that her mother, when given an intelligence test at the state hospital where she was taken after Anna's discovery, obtained an I.Q. of 50 and was classed as the "middle-grade moron type."

The hypothesis that Anna was congenitally defective (Davis, 1947) would seem to be supported by the case of Isabelle, who devel-

oped more rapidly after a similar period of isolation (Mason, 1942).

By coincidence, Isabelle was found only nine months after the discovery of Anna, who was about the same age. Isabelle, also illegitimate, had been locked up by her mother's family for six and a half years in a darkened room with her mother, a deaf-mute. Though Isabelle had communicated with her mother by simple gestures, she was unable to speak and made only a strange croaking sound when discovered. Her legs were so badly bowed by rickets, owing to lack of sunshine and proper diet, that the soles of her shoes came nearly flat together. This condition was later corrected surgically so that normal walking and running were possible.

When she was found, Isabelle's behavior toward strangers was like that of a wild animal, full of fear and hostility. She spent the first two days crying and refused to eat anything but a little milk and crackers until a psychologist from Ohio State University, Dr. Mario K. Mason, was able to win her confidence. Though at first Isabelle was believed to be "wholly uneducable," Dr. Mason, aided by psychologists and student teachers, decided to try to teach her. After interesting her in a doll, a watch, and a ring by the use of gestures, and after working hard with her for a whole week, Dr. Mason succeeded in getting Isabelle to say "buh" for "ball" and "ah" for "car." This occurred on November 25, 1938. By the following February 8, Isabelle was using such sentences as, "That's my baby." Early in March she showed that she was developing social manners by asking Miss Mason to "Say please" when making requests. By that time she could identify the words "blue" and "yellow" in printed form and match them with the appropriate colors. She continued this rapid progress until at the end of a year she knew many printed words and sentences, could write well, count to twenty and do addition to ten, sing "with gusto and accuracy," and retell a story she had heard.

At the end of twenty-two months in her new environment, Isabelle was regarded as normal in intelligence. She had covered in about two years a span of development that it takes a child six years to cover under normal conditions. Her personality had become affectionate and lovable. Though she was somewhat stubborn, she had an excellent sense of humor and loved to tease. She asked intelligent questions about all kinds of subjects, loved music and rhythmic activities, and showed good artistic taste. The latest report on Isabelle was at the age of fourteen, when she had just passed the sixth grade. She was participating freely in a variety of

school activities and making an excellent social adjustment

Cases such as those of Anna and Isabelle demonstrate the important role environment plays in the development of behavior. Although inadequate diet probably retarded Anna's physical growth to some extent, her maturational level, though low as compared to other children her age, was still noticeably greater than her behavioral level. Her biological structures were ready to function, but her environment was too impoverished to call them into action. However, once she was given opportunity to learn, improved behavior patterns began to develop—limited, however, by her low innate capacity. Isabelle, on the other hand, had been retarded largely by her poor environment and, having a much higher inborn capacity, made a more striking improvement when given the opportunity to learn.

In reviewing these and other studies of infant isolation, one psychologist (Stone, 1954) has suggested that another factor contributing to Isabelle's greater achievement may have been that her early "isolation" was not complete. Although Isabelle's deaf-mute mother gave her no specific training, she nevertheless provided some experience of human relationship. This investigator concluded that retarded development during infancy does not necessarily mean a poor heredity but rather may reflect deprivation: "the absence—not of specific training—but of the basic stimulation by human relationship which appears to be a prerequisite to normal growth."

Animal studies with restricted environment. A recent series of experiments conducted at McGill University in Canada has shown that the behavior of dogs raised under restricted conditions is inferior to that of unrestricted dogs in a number of important respects.

In the first of these studies three male Scottish terrier puppies were raised for seven and a half months in a cage. Although the cage was lighted, the dogs could not see out and had no contact with human beings except at feeding time. Three litter mates of the restricted puppies were raised as pets.

When the puppies were released after the seven and a half month period, they were much more active in familiar situations than were their litter mates who had been raised under normal conditions. In most unfamiliar situations they tended to continue

exploratory activity longer. In some new situations, however, they showed a peculiar "freezing" behavior. This may even have involved some anesthesia, since the restricted dogs submitted quietly to injections whereas the normal dogs protested vigorously. If placed in cages for the night, the restricted animals tended to withdraw into a corner when the examiner came to release them. Those raised as pets, on the other hand, were eager to get out. Although some of this peculiar behavior soon disappeared, traces of it remained after six months and the tendency to be excessively active lasted for over a year.

After two and a half months, when given a "fighting for a bone" test, the restricted dogs showed a tendency to share the bone, in contrast to the battling pets. The restricted animals were much more indifferent to the presence of a strange dog. After twenty-four hours of food deprivation they showed less than normal activity at the sight of a dish of food outside the cage, whereas the normal dogs became more active (Clarke *et al.*, 1951)

These findings about the effects of early restriction upon activity in dogs were confirmed in a later experiment which used a greater number of subjects—twenty-six Scottish terrier puppies descended from a single litter—raised under varying degrees of restriction (Thompson and Heron, 1954). This follow-up study also investigated the effects of early restriction upon problem-solving ability. The restricted dogs showed inferior ability on every type of test used—simple orientation tests, delayed reaction tests, and maze tests. Throughout the experiment they showed a lack of ability to discriminate the relevant aspects of the situation and to adapt to changes in the environment. Their ability to pay attention also seemed to be impaired. The experimenters concluded that, in the case of dogs, early deprivation seems to have "a definite and fairly permanent retarding effect" on ability to learn in later life (Thompson and Heron, 1954).

Another interesting study with dogs has shown that restricted animals are also retarded in emotional development.

A number of harmless but emotion-provoking objects—a bear skull, an umbrella, a live rabbit, etc.—were used as test objects. The experimenter recorded each response under the category of diffuse emotional excitement (aimless, rapid movement or "stalking," but no definite approach or withdrawal), avoid-

ance (either running away or turning so that the object was out of the line of vision), or aggression (approaching the object and barking or snapping).

In tests made three to five weeks after their release, dogs who had been raised in a restricted environment made significantly more responses of diffuse emotional excitement than did the free-environment dogs. The latter made significantly more avoidance responses but only one aggression response.

In tests made ten to twelve months after release, the restricted dogs still made more diffuse responses than did the free-environment animals. By this time both groups were making about the same number of avoidance responses, but the free-environment dogs made many aggression responses—whereas the restricted dogs made none (Melzack, 1954).

The experimenter's conclusion was that a long period of "well-organized experience of the environment in which emotion-provoking objects will appear is necessary for the emergence of adaptive emotional behavior such as avoidance and aggression."

These studies with human and animal subjects illustrate rather dramatically the role which environment can play in the development of physical, emotional, intellectual, and social characteristics. Human behavior is indeed a product both of maturation and learning.

MATURATION LIMITS LEARNING

We have seen that in the development of all new behavior patterns, even where learning is an important factor, no amount of practice will produce the behavior pattern until a certain level of maturation has been reached. As the underlying structures mature, less and less practice is needed to achieve the same level of performance. This is clearly brought out in an experiment conducted to determine the relative influence of practice and maturation on ladder-climbing skill.

Children twenty-four to thirty-six months old were divided into two matched groups. One of them, the practice group, was allowed to climb a two and a half foot ladder to a table top on which interesting toys had been placed. During the twelve-week practice period the toys were frequently varied so that they would continue to be an incentive for climbing the ladder. By the end of the twelfth week, this group had acquired considerable ease and skill of performance.

The other group had no opportunity to practice

climbing—although they did, of course, practice other habits, such as walking, which have something in common with ladder-climbing in that they involve muscular strength and coordination. At the end of twelve weeks this isolated group was given a table full of toys which could be reached by a ladder. Within a week these children were able to climb the ladder as well as the practice group could (Hilgard, 1932).

The isolated group in this experiment was able to catch up quickly with the practice group because *at a later stage of maturation less practice is required to achieve a given level of performance.*

We do not know exactly for how long it is possible to withhold the opportunity for learning without producing a permanent loss in capacity to respond to a stimulating environment. What evidence exists, however, suggests that there may be a "golden age" for learning particular skills—that is, a particular maturational level at which a child can learn certain skills with greater ease than at any other time, either earlier or later.

A classic experiment by McGraw clearly shows the importance of maturational readiness for learning and suggests that there may be a "best time" for learning any skill.

This experiment was an intensive study of non-identical twin boys, Johnny and Jimmy, who from their third week of life were subjected to enormously different training in athletic skills. Johnny, physically inferior to Jimmy at birth, was stimulated and helped in physical exercise of all kinds and was encouraged to be self-reliant in overcoming obstacles. Jimmy, however, played unhindered, with no special training either in motor skills or in self-reliance. Periodically the two boys were compared with each other and with a group of normal children serving as controls.

These observations showed that maturational readiness was constantly interworking with the effects of practice. It is interesting to note, for instance, that both twins took a few steps alone when nine months old, although Johnny had had practice in stepping movements from twenty days. Also, while Johnny could roller-skate and swim successfully by the time he was sixteen months old, it was not until he reached nineteen months that his intensive training in tricycling suddenly produced marked progress. Evidently, his neuromuscular mechanisms were mature for roller-skating earlier than they were for tricycling. Finally, when the twins were twenty-two months old, Jimmy was given two and a half months



Children gifted with special abilities often give evidence of their capacities in babyhood. At twelve the girl at right is an outstanding rider, competing successfully against adults. Before she was three she could build a higher block tower than any other child her age at the Yale Clinic of Child Development. The unusual hand coordination essential to superior horsemanship was evident even at that early age.

of intensive practice in the same activities that Johnny had been trained in. Here again the importance of maturational readiness was evident, for Jimmy easily mastered some activities, such as tricycling, in a shorter time than Johnny had taken at an earlier age when his neuromuscular mechanisms had apparently not been mature for that particular activity. But in learning to roller-skate, Jimmy definitely did less well, probably because he was at a later stage of development when his attention could be more easily distracted. The practiced Johnny was also consistently superior to Jimmy in courage and muscular coordination. Evidently those first twenty-two months of training and practice had come at an advantageous stage in Johnny's development (McGraw, 1935).

When the twins were about two years old, the training was stopped, and they were returned to their home. After that they were examined in these same performances at intervals of from six weeks to two months until they were six years old. As far as is known, they had little or no practice in either tricycling or skating after their early training in the laboratory. Yet these two skills seemed to deteriorate at different rates. At six both boys showed deterioration in roller-skating, in which their greater

height was a handicap, whereas neither showed deterioration in tricycling, in which bodily changes are apparently not so important a factor. This is further evidence that motor skill is definitely influenced by the stage of bodily development (McGraw, 1939).

This study seems to indicate that the first two years are a very rewarding time to encourage children in athletic feats, although different skills can most easily be developed at different ages. Jimmy's greater maturity when he received his first training never enabled him to catch up all the way and even handicapped him in some skills.

[PSYCHOSOCIAL DEVELOPMENT]

Heredity and environment work together to direct behavior and development. But, as we have suggested, the individual is not just a

passive victim of physical and chemical forces. Both common sense and experimental observations tell us that behavior is largely an individual reaction. In any given situation the *average* individual will *tend* to behave in a certain fashion, but no one can predict exactly what a specific individual's behavior will be—in fact, it may not follow the average pattern at all. If you have had nothing to eat for four or five hours, for example, and food is placed before you; you probably will eat it. But what will you eat first? Will you leave the vegetable untouched because you don't like it, or will you make an effort to eat some just to be polite? Will you decide to drink coffee or milk or water? Or will you decide not to eat anything at all because for some reason or other you "just aren't hungry"?

In all of your daily activities you are constantly aware of making "decisions" and "choices." Over a period of time you realize that you have changed your attitudes and patterns of behavior. Always you think of yourself as a unique human being, working toward your personal goals and reacting to people, events, and situations as *you* see them and as they affect *you*.

/ A child's discovery that his toes really belong to him marks a significant step in the development of his self-concept.



THE SELF-CONCEPT

Upon entering the world, a baby finds it, to the best of our knowledge, a vague blur—a "blooming, buzzing confusion." As he begins to mature and to find order in his environment, one of the most important things he learns is a *concept of self*. At first the infant probably cannot distinguish between himself and the rest of the world, nor does he realize even that parts of his body belong to him. As Strang has said, "It is a notable day when he first realizes that his toes belong to him instead of to the world in general. He is doubtless perplexed during the first year by the fact that his shoes come off at night while his feet do not" (Strang, 1938).

The development of the self-concept involves a process of gradual *differentiation*. The child early begins to distinguish the sound of his own voice as different from that of his mother's. As his sensory mechanisms and musculature become more mature, he explores his environment more attentively. During this process of exploration, he begins to "discover" himself—just as he learns to distinguish his bottle and rattle so does he accidentally discover his mouth, fingers, toes, genitals, and other body parts. Finally, as his background of experience increases, he begins to *integrate* the separate elements he has differentiated out of the blur that greeted him at his birth. He gradually realizes, for example, that his mother's voice and mother's image are really only different aspects of the same object, which he will later learn to call "Mother." In the same way the child learns to recognize all of his body parts and inner feelings as part of a single going concern.

As the child learns to use and understand language, his concept of himself develops at a faster rate. In fact, many of his most basic ideas about himself come from hearing the comments of others. If he usually hears, "Johnny is a good boy," he will probably develop a more satisfying self-concept than if he usually hears, "Johnny is a bad boy" (Dewey and Humber, 1951). His ideas not only about himself but about the world in general will reflect the appraisal of those guiding his development.

By the time the child is about two years old he uses the word "mine" often and decisively. He begins to refer to himself as "I" and

learns by the time he is three that "you" are a person with feelings and rights also. Little by little he has come to recognize differences between his own purposes and those of others around him, who may either help or oppose him in his intentions (Jersild, 1952). As Gesell, who has made very extensive studies of children's behavior, has expressed it: "You can bargain with Three. He knows with a clarity that was quite wanting at Two that he is a person and that you are a person. And he negotiates reciprocal trade agreements" (Gesell *et al.*, 1940). By the time he is four he can see himself in some perspective, as one of a group of children, all persons more or less equivalent to himself. This identification with the group was illustrated during one of Gesell's psychological examinations, when a four-year-old asked, "Do you spank children who don't finish?" Thus the child gradually differentiates himself from the world about him and in so doing becomes capable of relating himself to others.

THE DYNAMICS OF SELFHOOD

As the child grows physically and psychologically, his self-concept develops into an elaborate system which includes not only his body as he knows it but all his thoughts, feelings, attitudes, values, and aspirations. This concept of self becomes, quite logically, the individual's most valued possession, and his behavior will largely be devoted to protecting and enhancing it. Whether or not his concept of self agrees with the evaluation of others, it is his real self as far as the individual is concerned—it is *he*. Similarly, the individual's concept of his environment is determined by his personal experiences with it.

These concepts directly influence the way an individual behaves, for they provide his only frame of reference for evaluating which action is best suited to any situation. An individual's behavior is always "purposeful, relevant, and pertinent to the situation *as he understands it*" at the moment of action (Snygg and Combs, 1949). Often we speak of another's behavior as "irrational," but what we are saying really is that in the same external circumstances we would have acted differently. Such behavior probably seemed to the person involved like the best way to meet the situation and to preserve his own self-concept.

We shall see how the principle of homeostasis operates on a physiological level to maintain the body's physical equilibrium. On a psychological level, a similar phenomenon seems to occur—the individual strives to order his behavior and control his environment in such a way as to protect his picture of himself. If we have come to think of ourselves as intelligent, honest, fair, good-natured, virtuous, and witty, for example, we strive by every possible means to maintain and enhance this picture.

The same principle holds true, unfortunately, if we are falsely convinced of being stupid, ill-tempered, guilty, or possessed of some other undesirable traits. The child who is sure that he has no aptitude for school, for example, will make little effort to prove otherwise and will even tend to explain away any occasional success as an "accident." All the common defense reactions—such as rationalizing our behavior, projecting our own thoughts or desires to another person, repressing or forgetting painful experiences—are unconscious psychological mechanisms for protecting our concept of self. Some principle comparable to homeostasis thus seems to operate on the behavioral level, in the organism's struggle to maintain its psychological organization as well as its physical equilibrium (Fletcher, 1942).

Because an individual's self-concept, once it has been clearly differentiated, tends to continue developing in the same direction in which it started, the early years of childhood are of the utmost importance in the development of a healthy self-concept. A healthy self is one that is fairly well *unified* and not in serious conflict with itself. It also agrees essentially with the picture that other people have of the individual. Furthermore, since everyone tends to perceive and react to others in terms of the way he perceives and evaluates himself, the healthy individual is one who accepts himself and thus can accept his environment and the people in it—each with his own needs and purposes and desires. He does not perceive people, circumstances, and events as a continual threat to the satisfaction of his own needs but rather is able to *use* his environment and to *integrate* new aspects of "reality" into his enlarging self-concept. While striving to maintain and enhance his self-concept, in other words, the individual should

be able to *adjust* to the constantly changing demands of life.

STAGES OF PSYCHOSOCIAL DEVELOPMENT

At each period in life there are particular kinds of tasks for each individual to perform, imposed on him by his society and made possible by the process of maturation (Havighurst, 1952). For example, environmental pressures are active in pushing a child toward learning to walk and talk. Walking and talking are "developmental tasks" of all young children in our culture, and the success with which these and other tasks are achieved has a great influence both on the individual's general adjustment and happiness and on his successful or unsuccessful achievement of subsequent tasks. In adulthood the demands and expectations of our particular environment are increasingly influential in determining the specific directions of our strivings and hence of our development.

The Midcentury White House Conference on Children and Youth has formulated several stages through which the individual normally passes during the course of his life (Witmer and Kotinsky, 1952). The list prepared by the White House Conference—and summarized below—is based largely on the work of Erik H. Erikson, who identified eight major conflicts in our culture which the individual normally must face at different times in his development (Erikson, 1950). According to Erikson's concept, if the individual is unable to resolve a particular conflict satisfactorily, he will be handicapped in resolving subsequent conflicts. When he is successful, on the other hand, he gains a new sense of achievement and greater actual adequacy for dealing with life. He incorporates into his concept of self a new quality which helps him face the next crisis in his development. The qualities of self listed below (the sense of trust, the sense of autonomy, the sense of initiative, etc.) are descriptive classifications which are especially helpful to clinical psychologists and psychiatrists in organizing and understanding the vast amount of information they have collected about self-development.

The sense of trust. The first important quality the individual develops is the sense of trust, which normally emerges during the first year of life. The infant begins to develop a

sense of trust when he first discovers that his basic needs, especially the need for food, are satisfied. He also finds that his mother can be counted on to provide attention and love. As time goes on, his own rapidly developing skills, such as the ability to grasp his toys or to sit up, enable him to trust his own body. All such experiences combine to give the child a basic faith in existence. He comes to feel that he can rely upon much of the world to be predictable and consistent.

Fortunately most infants have little trouble developing this all important sense of trust because their needs at this early stage are nearly always satisfied. Either a mother or a mother substitute may satisfy these needs; there is no mystic bond between parent and child, no reason to believe that the mother influences her offspring in some manner unrelated to her behavior (Baldwin, 1955).

The sense of autonomy. When the child is about twelve or fifteen months old he begins trying to assert his own individuality, a struggle that is particularly intense for about the next two years. He should come to feel that he is an adequate human being, self-reliant but nevertheless able to use the help and guidance of others in important matters.

The physiological basis for this stage of development is the state of muscular coordination the child has achieved, enabling him to walk, talk, and manipulate objects in various ways. He meets many frustrations from his physical environment (in being unable to reach objects, climb walls, and so forth) and from his parents and other adults, who may disapprove of many of his activities. It is important, therefore, that in handling a child at this stage his parents give him the opportunity to make whatever choices he is ready to make for himself, while at the same time they help him learn to accept necessary restrictions. They should be consistent in both what they allow and forbid him to do. If the child learns to develop the proper ratio of cooperativeness and willfulness, he will attain self-control without loss of self-esteem.

The sense of initiative. Having established himself as an individual in his own right, the four- or five-year-old next seeks to discover how much he can do. He observes and imitates the activities of adults and engages for hours in imaginative play.

The main problem the child faces at this stage of his development is how to experiment

with things and exercise his will as widely as possible without suffering too many feelings of guilt. Because his conscience has started to develop, his behavior is guided at least partly by his notions of right and wrong. He often feels guilty for his thoughts as well as deeds. As in the preceding stage, a satisfactory solution depends upon giving the child all possible freedom and encouragement in carrying out his projects and imposing only necessary restrictions. Since so many of his enterprises will be physically impossible or socially unacceptable, he may otherwise become so discouraged that he will never develop the ability to select special goals and persevere in reaching them.

Although this stage of self-development is very difficult for the child, it can be richly rewarding. At no other time of life does the individual learn so willingly or feel so important when he shares in obligations and achievements. The sense of initiative developed at this early age should continually be fostered since so many factors in contemporary life stress conformity.

The first three stages of personality development listed by Erikson and the White House Conference seem to be the most important. If the child satisfactorily achieves a sense of trust, of autonomy, and of initiative, he will probably have a minimum of difficulty with later conflicts. The child who gets a poor start in developing a healthy self-concept, on the other hand, faces a tremendous handicap in making later adjustments.

1. The sense of duty and accomplishment. During the years from six to twelve the child tends increasingly to engage in real tasks that are socially useful. This stage of development is a time of calm, steady growth. It is a period of learning new skills and social abilities, a period when the child needs to make real achievements in accordance with his own particular abilities. The chief danger at this point is that he may develop a sense of inferiority if too much or too little is expected of him.

The school plays a particularly important role in helping the child develop a sense of industry and accomplishment. Teachers should make every effort to gear their requirements to the individual so as to give him the experience of success commensurate with his abilities.

The sense of identity. The problem of identity is central during adolescence, when rapid

physiological changes contribute to inner turmoil and indecision. The adolescent is constantly faced with questions concerning who he is and who he is to become. Is he child or adult? What profession shall he enter? How does his race or religion affect people's attitudes toward him? Such questions as these often cause the adolescent to become morbidly preoccupied with what others think of him and with what he should think of himself.

Faced with this confusion in his status the adolescent often seeks security by fostering similarity to others of his age group. He develops stereotyped behavior and ideals and often joins narrow cliques—if the “kids” do it, it is the right thing to do; if the “kids” disapprove it, avoid it like the plague. The greatest danger of this period, however, is self-diffusion. With so many physical and social changes taking place and so many decisions to be made at once, it is no wonder that the adolescent often feels he has nothing to hold on to. He can overcome this feeling of diffusion more readily if, during the previous stages of his development, he has gained a healthy sense of self-esteem and a feeling that he is moving toward a future where he will have a definite role to play.

The struggle of the adolescent is one to preserve a sense of continuity between his childhood and his future. Thus the sense of identity is not only one of the most difficult of all the “senses” to achieve but one of the most important.

The sense of intimacy. Only a person who is sure of his own identity can share satisfying intimate relations with others—either in the form of friendship with members of the same sex or love for a member of the opposite sex. Thus true intimacy develops rather late in adolescence. The earlier attachments formed by boys and girls tend to be relationships that help them define their own identities. Later intimate attachments, in contrast, involve a real sharing. They are close, mutually satisfying relationships in which neither person is dominating or submissive.

Traditionally, American culture has placed little emphasis on this aspect of development—while it has been unusually successful, on the other hand, in encouraging independence, initiative, industry, and identity. Thus many adolescents never adequately solve the problem of developing a sense of intimacy, though they excel in the competitive aspects of life.

The parental sense. The parental sense, characterized by interest in producing and caring for one's own children (or sometimes by interest in guiding and caring for children who are not one's own), does not usually appear until the individual reaches adulthood. It is not merely the desire to have children but is essentially "the desire to nourish and nurture in its essence what has been produced. It is the ability to regard one's children as a trust of the community rather than as extensions of one's own personality or as beings that one merely happens to live with" (Witmer and Kotinsky, 1952).

An individual's failure to develop an adequate parental sense may stem from failure to solve some of the earlier problems of self-development. If the parent has never achieved the sense of intimacy, for example, he may constantly seek companionship and yet be unable to achieve a really warm relationship. If he lacks a sense of identity he may treat himself as a child and even act as a social rival to his own children. Cultural values are also important, for a person cannot fully develop the parental sense unless the role of a parent is respected by his society. The economy, too, must be such that the parent feels he has a meaningful part to play and that he can depend on future security. Only if he is secure himself—personally, socially, and economically—can he concentrate on rearing his children in the best way possible.

The sense of integrity. The culmination of healthy self-development, according to Erikson and the White House Conference report, is achieving a sense of integrity. This means acceptance, in the deepest sense, of oneself and one's role in life. As Erikson says of integrity:

"It thus means a new, a different love of one's parents, free of the wish that they should have been different, and an acceptance of the fact that one's life is one's own responsibility. It is a sense of comradeship with men and women of distant times and of different pursuits, who have created orders and objects and sayings conveying human dignity and love. Although aware of the relativity of all the various life styles that have given meaning to human striving, the possessor of integrity is ready to defend the dignity of his own life style against all physical and economic threats. For he knows that . . . for him all human dignity stands or falls with the one style of integrity of which he partakes" (Erikson, 1950).

The person lacking integrity often wishes that he could live his life over again. He finds it hard to accept his short life span as his one chance for achievement and may be filled with despair and disgust. Most people experience some of these feelings from time to time, for integrity is only gradually and imperfectly achieved.

It is crucial that a high proportion of adults in a culture achieve a considerable degree of integrity. Only well-adjusted adults can successfully guide the development of new generations so that they in their turn become integrated and effective human beings. Fortunately it is often possible for a person to overcome early handicaps in his development and, rather late in life, to achieve the feelings of identity, intimacy, and integrity characteristic of effective adulthood.

S U M M A R Y

To understand why every individual is unique and at the same time shares many characteristics with other human beings, we must consider the roles of heredity and environment in shaping human development.

The heredity an individual receives at the time of his conception makes him a unique individual even at birth. Characteristics of both parents—and of many preceding generations—are passed on to the child through the union of the father's *sperm* and the mother's *egg*. The fertilized egg from which the child develops receives exactly the same number of chromosomes from each parent. Locked in the chromosomes are many thousands of genes, each of them responsible—either alone or in combination with other genes—for the development of a particular characteristic. Except for identical twins, who receive the same chromosomes, no two individuals have exactly the same heredity.

Heredity puts a limit on the level of development an individual can achieve in a given period of time. Environment, on the other hand, determines the degree to which an individual will achieve his hereditary potentialities. The individual's behavioral level at a given time in life is not determined by either heredity or environment working alone but rather is the product both of maturation and

of *learning*. The effectiveness of a particular environment in stimulating learning is always limited by the individual's maturational level.

Because the organism has very little opportunity to learn during the *prenatal period*, fetal development is largely a product of maturation. Learning begins to play an increasingly important role after birth, but until the organism reaches physical maturity many kinds of development are determined chiefly by heredity acting over a period of time. Important maturational changes involve development of the skeletal structure, the internal organs, the brain and nervous system, the muscles, and the sensory equipment.

Although the *rate* and *pattern* of maturation differs significantly from child to child, the maturation process always follows an *orderly sequence*. As a rule it is characterized by a pattern of *individuation*—of development from whole to part, from general to specific. The organism always *matures as a unit* and thus can adjust to its environment in a coordinated manner.

The ductless glands, or *endocrines*, have a major part in *regulating* physical development. The *hormones* they secrete control the *rates* of certain bodily processes associated with maturation and have an important influence on the individual's *metabolism*. Endocrine activity also aids the process of *homeostasis*. Perhaps the most important of the endocrines is the *pituitary*, because it performs the double function of controlling childhood growth and of stimulating other endocrine glands through its "middle man" hormones. Other endocrines which influence development include the *thyroids*, the *adrenals*, and the *gonads*.

The innate potentialities of the organism can unfold only when environmental conditions are favorable to development. The environment supplies the stimuli which set

off patterns of response already prepared by maturation. It also provides situations which are conducive to the individual's learning new patterns or altering old ones. Studies of both human beings and animals raised in restricted environments show clearly that environmental opportunity is very important in determining the level of development a particular organism achieves.

Instinctive behavior, though commonly found in the lower animals, occurs very rarely—if at all—in man, whose superior brain and nervous system afford him far greater opportunity to profit from environmental stimulation. Particular human behavior patterns fall somewhere in a continuum between pure instinct and pure learning, depending on the degree to which learning acts with maturation in their development.

Through the interaction of heredity and environment, a child gradually develops his *concept of self*. This includes all the thoughts, feelings, attitudes, values, aspirations, habits, and skills which the individual regards as uniquely his own.

The basic course of healthy self-development can be described in terms of eight stages, or "senses." These are the senses of *trust*, of *autonomy*, and of *initiative*, all formed during early childhood and basic to successful development at later stages; the sense of *duty and accomplishment*, based on experiences of successful achievement in later childhood; the sense of *identity*, a central problem of adolescence; the sense of *intimacy*; the *parental sense*; and the culminating sense of *integrity*, which involves realistic acceptance of oneself and one's role in life. The individual's self-concept is an important factor in determining how he will perceive and react to his environment and the extent to which he will fulfill or deny his inherited potentialities.

CHAPTER THREE

THE MEASUREMENT OF INDIVIDUAL AND GROUP DIFFERENCES



AREAS OF MEASUREMENT

WHAT MAKES A GOOD MEASURING
INSTRUMENT?

PSYCHOLOGICAL TESTS

OTHER TECHNIQUES OF MEASUREMENT

THE PSYCHOGRAPH

STATISTICS IN MEASUREMENT

To gather complete and accurate data in its particular area of study, each of the physical sciences must use suitable instruments of measurement. Similarly, psychology has had to develop appropriate techniques for measuring the various aspects of human personality as accurately as possible. Among the most important of psychology's measuring "instruments" are: (1) psychological tests, (2) rating scales, (3) interviews, (4) self-inventories, (5) behavior sampling, and (6) projective techniques. A single glance at this list indicates the variety of techniques necessary for measuring the complexity of human personality.

The accurate measurement of individual and group differences has been greatly facilitated by the use of statistical procedures. Statistics are used, first of all, to determine how well a particular measuring instrument can be trusted. Secondly, statistical techniques help the psychologist organize and interpret vast amounts of information. They are especially valuable in enabling him to make accurate comparisons between various individuals and groups.

AREAS OF MEASUREMENT

When psychologists use the word "personality," they are not thinking of a mysterious quality that some people, such as movie stars and politicians, have more of than most ordinary people do. Personality, as they think of it, refers to the whole person—"the thinking, feeling, acting human being, who, for the most part, conceives of himself as an individual separate from other individuals and objects" (Witmer and Kotinsky, 1952). From this point of view, the individual does not *have* a personality; *he is* a personality.

In studying human behavior, psychologists are concerned with the total personality—that is, with the whole person. For the convenience of study, however, it has been helpful to regard personality as having three related aspects: (1) the individual's external appearance and behavior, or social stimulus value; (2) his inner awareness of self as a permanent organizing force in life; and (3) his particular pattern or organization of measurable traits, both "inner" and "outer." Although none of these aspects of personality can be strictly

separated from the others, each lends itself to certain special techniques of measurement and study.

SOCIAL STIMULUS VALUE OF THE INDIVIDUAL

An individual's social stimulus value is the effect he has upon others. It is determined by all those characteristics and qualities of the individual that act as stimuli on other people—physique, hair color, complexion, mannerisms, ways of talking, friendliness, helpfulness, and so on.

The social stimulus aspects of personality are an important concern of sociologists and psychologists, but they do not always reveal the true structure of personality. Just as the Greek actor's mask concealed the performer's identity, the individual's outer appearance and behavior may conceal his actual psychological make-up. The swindler who wins victims by his charming smile, the gruff person with "a heart of gold," the blusterer who is

inwardly timid and fearful—all these, and many others, are examples of persons whose social stimulus value partially hides their true nature. To gain a full understanding of an individual's personality, therefore, we must go beneath outer appearances and study his inner dynamics and his traits, as measured by various standardized tests and other methods of observation.

INTRAPERSONAL ASPECTS OF PERSONALITY

As we saw in Chapter 2, the individual's concept of self, once acquired, becomes an important factor in guiding the further development of his personality. The self is the personality "viewed from within." Into it are integrated all the human being's experiences with himself and his environment. Thus it becomes one of the chief organizing forces in his life.

In addition to the conscious self, a person's intrapersonal organization includes unconscious elements of which even he is not directly aware. The psychologist studies these deeper, unconscious levels of personality by such methods as *hypnosis* and *projective techniques*. We need to study both the conscious and unconscious aspects of intrapersonal structure to gain an adequate understanding of personality.

TRAITS AND PATTERNS OF INDIVIDUALITY

Another approach to personality is the study of individual *traits*. Traits are defined as characteristics—such as numerical or musical ability, masculinity, sociability—that can be observed and tested objectively. These are often called *dimensions* of personality because they can be measured on mathematical scales, or *continua*s. Since traits differ in every individual, the study of individual differences is sometimes referred to as "trait psychology."

No definite number of possible traits has been established, but one study has listed in alphabetical order 17,953 names of human traits (Allport and Odhert, 1936). The very largeness of this number suggests that many of these names actually refer to the same underlying human characteristics. Some psychologists have tried to study the interrelations of such traits to reduce them to a smaller

number of basic underlying factors (Cattell, Dubin, and Saunders, 1951; Guilford *et al.*, 1954).

The basic question in describing a given individual is not deciding which traits he does or does not possess, for traits are not all-or-nothing characteristics. Instead, psychologists ask *how much* an individual has of each important trait. Traits are present in varying degrees and can be measured by a variety of techniques which psychologists have gradually developed.

WHAT MAKES A GOOD MEASURING INSTRUMENT

In developing or using various devices to measure personality and behavior, the psychologist must answer four important questions: (1) Does the device really measure what it is supposed to measure? (2) Does it give consistent results for the same subject, so that he would score the same way if he were tested again under identical conditions? (3) Can the trait being measured be defined objectively so that two or more persons can score the subject's responses and obtain the same result? (4) Can the subject's score be interpreted in relation to the scores of other individuals in a defined group, i.e., is the test well standardized? To answer these four questions about a test or other measuring instrument—that is, to decide how well it can be trusted—the psychologist must check it for *validity*, *reliability*, *objectivity*, and adequacy of *standardization*. Though we need not go into how this is done, it is important to understand what is meant by these terms.

VALIDITY

The validity of a measuring instrument is the extent to which it actually measures what it was designed to measure. When we are making physical measurements, validity usually poses no great problem. It is obvious enough, for example, that a yardstick measures length or that a thermometer measures temperature. But in measuring psychological characteristics, it is much harder to establish validity. A test designed to measure *inborn*

intelligence, for example, may not adequately discount the factors of schooling and home advantages.

The index of validity is the extent to which the instrument accomplishes the purpose for which it was intended. Thus, if a psychologist devises a test of mechanical aptitude and discovers that persons who get high scores on the test are nearly always successful as mechanics whereas those who get low scores are nearly always unsuccessful, he may be relatively sure that his test is valid. It takes time to determine the validity of such a test, for applicants must be hired and work for a period of time before their actual performance can be compared with their test scores. In addition, validity is always specific to a particular purpose. For example, a test may be valid for selecting salesmen but be invalid for selecting clerks.

RELIABILITY

The reliability of a measuring instrument is the degree to which people earn the same relative rank or score each time they take the test. High reliability is obtained when errors of measurement determining a score are low. If it is a matter of chance whether a subject does well or poorly on the test, we say that it is unreliable.

A test cannot be valid unless it is first of all reliable, but reliability in itself does not guarantee validity. The fact that a subject makes the same score on a given test each time he takes it does not necessarily mean that the test is measuring what it purports to measure. Reliability, in other words, is merely a means to the end of validity.

OBJECTIVITY

One of the most common causes of unreliability in a psychological measuring instrument is the inclusion of items which must be scored on the basis of subjective judgment. Such a test lacks objectivity. To be reliable a test must be set up in such a way that two or more persons can score the responses and get the same results. In assessing many personality traits, people instead of instruments must act as the measuring stick, and in such cases it is almost impossible to obtain an accurate, objective measurement uncolored by personal feelings and attitudes.

STANDARDIZATION

To be most useful a test must be standardized—that is, administered under standard conditions with standard instructions to a large group of persons who are representative of the individuals for whom the test is intended. This representative sample may be drawn from the general population if the test is to be used, say, for classifying inductees in the army. But if the test is to be used to select applicants for admission to college, it might better be standardized on college students. The purpose of standardization is to obtain *norms*, or standards, so that an individual's score can be compared with the scores of others in a defined group. If sex differences influence results on the test, norms for the two sexes should be provided separately. In some instances age-group norms are required.

The various ways of presenting norms or standards will be discussed later in this chapter. In general it is done through tables which tell how many scores in the standardization group a particular score equals or exceeds. Often the individual scores are expressed in terms of *centile ranks*, or "position in a hundred" (page 87).

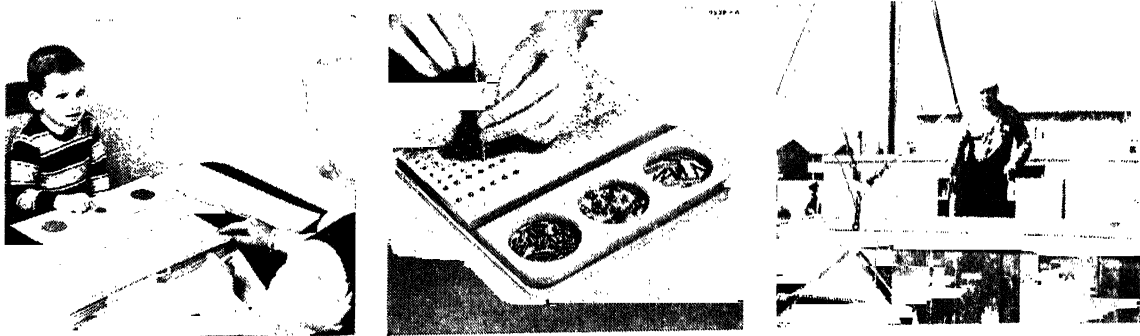
PSYCHOLOGICAL TESTS

In personality measurement, the goals of reliability and objectivity are most readily achieved when the measuring instrument is a *psychological test*—a carefully planned situation in which the individual's responses can be described by a numerical value or score. For example, in a test of memory ability the subject may be given a poem or a list of nonsense syllables to memorize. His performance may be scored either according to the length of time he requires to learn the material or according to the number of lines or syllables he can recall after having studied the material for a given number of minutes.

KINDS OF TESTS

Psychological tests may be classified in several different ways:

1. Tests may be grouped according to the *aspect of the individual's behavior they meas-*



Psychological tests have been developed to measure all kinds of abilities and capacities. From left to right above we see a boy taking an individual, nonverbal, mental maturity test; a subject taking a performance test designed to measure fine eye-hand coordination; and a sailor taking a situational electric-winch test developed by the author for the United States Navy.

ure. Thus there are tests of reasoning ability, school achievement, vocabulary, finger dexterity, vocational interests, medical aptitude, and many others.

2. *Verbal or nonverbal.* Some tests require the subject to use language either in interpreting directions or in taking the test; others do not.

3. *Group or individual.* A group test may be administered to many subjects at the same time, whereas an individual test is given to only one person.

4. *Speed or power.* Either of these may be used to test ability to perform various tasks. In the speed test, the score may represent either the amount of work done in a constant period of time or the amount of time needed to complete a constant amount of work. In the power test, unlimited time is allowed and the score expresses the degree of difficulty of the tasks the individual can accomplish.

5. *Analytic or situational.* Tests which measure the separate component traits into which complex performance patterns may be analyzed are called analytic tests. For example, ability to drive an automobile may be broken down into a number of specific traits, including visual acuity, reaction speed, eye-hand coordination, and the like, each of which may be measured by a different analytic test. Tests which present a miniature life situation and measure performance under conditions which require traits to be organized into functional units are called situational tests. This type of test is frequently used to measure ability to drive an automobile in states where an applicant for a driver's license must drive over a

designated course while the examiner rides at his side and notes errors of operation. Such situational tests provide an appraisal of total integrated processes as they occur in real life, but they do not yield precise scores in most cases because they tend to be subjective and unreliable. Analytic tests, on the other hand, provide more accurate quantitative measurements but are limited in that they measure only isolated traits.

These classifications of tests are not mutually exclusive, for a given test may fall into more than one of the above categories. A group test, for example, will be either verbal or nonverbal, may be a speed or a power test, and so on. Many finer distinctions between kinds of tests could also be made.

INTELLIGENCE TESTS

Psychological tests have been developed to measure all kinds of human capacities and abilities, but without doubt, the most active test-making has been in the area of intelligence tests. No aspect of human personality has been studied more intensively than that of "general intelligence." In recent years, as we shall see, psychologists have devoted increasing attention to the task of analyzing intelligence into its various component factors, but the more general tests of intelligence are still widely used. Business and industry, for example, use the intelligence test as one basis for hiring or refusing to hire. The schools use it to help classify pupils into slow-learning and quick-learning groups and to discover what level of performance can realistically be

expected from each individual. The experience of the armed services in both World Wars has left no doubt of the importance of a thoroughgoing, scientific, intelligence testing program. Today the intelligence test, already more than fifty years old, has become an important means of informing an individual about himself so that he can plan his life, predict the probable outcome of his various efforts, and gain similar insight into the efforts of others.

The Binet tests of general intelligence. Intelligence testing began in the year 1904, when the Minister of Public Instruction of France formed a commission of medical men, educators, scientists, and public officials to study the problem of how to teach the feeble-minded children in the public schools. The important work of this commission was done by Alfred Binet, a scholar of the young science of psychology, and Théodore Simon, a physician. These men believed that before a program of instruction could be planned it was necessary to work out some way of measuring the children's intelligence.

Binet prepared a test of intelligence which was tried out in 1905. It contained problem situations which were selected with extreme care and which could be scored accurately. They were varied in nature, were little influenced by differences in environment, and called for judgment and reasoning rather than mere rote memory.

The concept of M.A. Binet expressed the results of his tests on feeble-minded children in terms of the age at which normal children could make the equivalent score. For example, if a particular defective earned the same score on the test as was earned by the average child of five years, the feeble-minded child was said to have a *mental age* (M.A.) of five years—no matter what his actual age was.

Binet's extensive use of intelligence tests showed conclusively that intelligence exists in an infinite series of degrees. There is no sharp break between the dull, the average, and the bright.

Binet's final scale (1911). The tentative scale of 1905 passed through a process of revision and standardization which finally culminated, in 1911, in a set of standards arranged by age levels (Binet and Simon, 1911). You can get a good idea of what the Binet scale is like if you know what is expected of a normal person at different ages.

Below are a few items from the original Binet test.

- Age 3 Points to nose, eyes, and mouth.
- Age 5 Counts four coins.
- Age 7 Shows right hand and left ear.
- Age 9 Defines familiar word in terms superior to use; i.e., shows how it is related to other ideas.
- Age 12 Uses three given words in one sentence.
- Adult Gives three differences between a president and a king.

The Stanford Revisions. The next important step in the development of intelligence tests was made by L. M. Terman, who used about a thousand children to try out Binet's materials together with other tests he had gathered from various sources or invented himself. He arranged the tests into mental age levels and in 1916 published the Stanford Revision of the Binet Tests, which remained for twenty years a standard instrument in clinical psychology, psychiatry, and educational counseling. These items cannot be reproduced without destroying their value for testing, but they resemble those from the original Binet scale.

In 1937 Terman and Merrill published a new revision of the Binet tests (Terman and Merrill, 1937), for in the course of twenty years the 1916 scale had revealed certain defects and limitations. For one thing it was not applicable to adults. The tests were too easy, especially for superior adults, and the scoring for adults was incomplete and gave misleading results. Moreover, the scale did not provide adequately standardized tests for very young children.

The most serious defect, however, was that the 1916 scale existed in only one form and hence did not permit immediate retesting. There are many times when a psychologist questions the reliability of a given test score because the testing conditions were unsatisfactory (as when the subject was afraid or sullen) or because the results do not seem consistent with other findings (as when a child who has received consistently high grades in school makes a low test score). In such cases retesting helps establish the reliability of the first score. In other instances the psychologist may wish to retest in order to determine whether mental deterioration has occurred. Since a subject cannot be tested at

close intervals with exactly the same form of test, an alternative form—one which has similar items but is different in specific content—is of great value.

The 1937 revision was aimed at correcting the difficulties and defects of the former scale:

1. The test was extended at the upper limits of the intelligence scale so that differentiations could be made among adults of superior intelligence.

2. Provision was made for testing children as young as two years old. Sets of tests were provided at half-yearly intervals for children from two to five, whose mental growth is very rapid, and at yearly intervals thereafter.

3. The 1937 scale contains two forms of mainly different but comparable materials so that when retesting is necessary the psychologist need not worry about a "practice effect."

The Stanford-Binet, as it is now referred to for the sake of brevity, has been responsible for the widespread use of the term *intelligence quotient*, or I.Q. Just how this concept is used will be discussed in more detail in Chapter 4. Briefly:

$$I.Q. = \frac{M.A.}{C.A.} \times 100.$$

In this simple equation M.A. is the individual's mental age (as determined by his performance on standardized test items), and C.A. is his actual chronological age. Mental age is defined as degree of mental develop-

The Seguin Form Board (Arthur Point Scale II, 1946 Revision) is one of the best known and most widely used form boards. The experimenter always places the board in the same position and stacks the pieces in the exact order and position shown above. He then times the subject's performance with a stop watch.



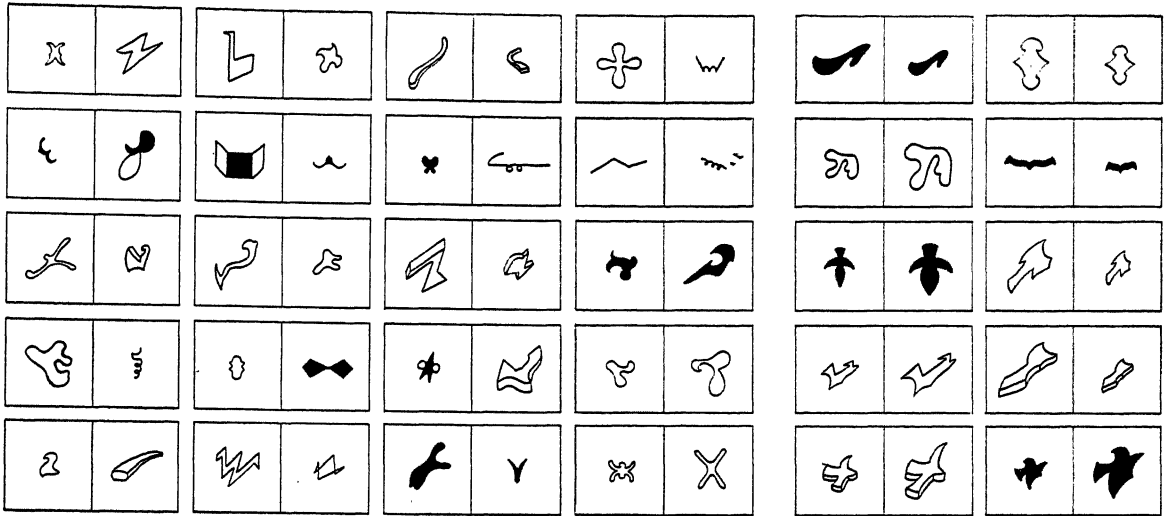
ment, measured in terms of the average chronological age of individuals who do equally well on the tests. The multiplication by 100 is simply to eliminate fractions and decimals, making I.Q.'s expressible as whole numbers. Thus if a child's mental age and chronological age are both 8, his I.Q. will be 100, which is considered average. If, however, his M.A. is 10 and his C.A. is only 8, his I.Q. will be 125.

Performance tests. The Stanford-Binet test is probably the most widely used of the individual intelligence tests because it correlates so well with grades in school and hence is invaluable in predicting a child's school progress and planning his curriculum. It is limited in one important respect, however, because it is predominantly a test of verbal intelligence—although it does measure other abilities. Thus for a deaf child or for a child of foreign parents who does not come from an English-speaking home, the Stanford-Binet often does not give a fair score.

It has been necessary, therefore, to develop certain tests called *performance tests* in which

Below is another of the tests found in the Arthur Point Scale of Performance. The subject looks at the incomplete picture, decides which block on the tray shows the missing item, and then fits that block into the proper blank space in the picture. Performance tests like this one and the Seguin Form Board are useful for measuring the intelligence of children who are deaf, who do not speak English, or who for some other reason would be handicapped by a test that depended mainly on verbal responses.





The concept of size is tested in the Series I cards used in Hoffman's study which was designed to measure the ability of subjects to form concepts. Two geometric designs appear on the face of each card. In the first twenty cards of the series one geometric design in each pair is decidedly larger than the other, but the two designs are also different in shape. In the last ten cards there is only one variable—the two designs are identical in shape and differ only in size. Therefore, the last ten cards in the series represent a simpler task for the subject who may have been unable to abstract the correct relationship between the paired designs while viewing the first twenty cards.

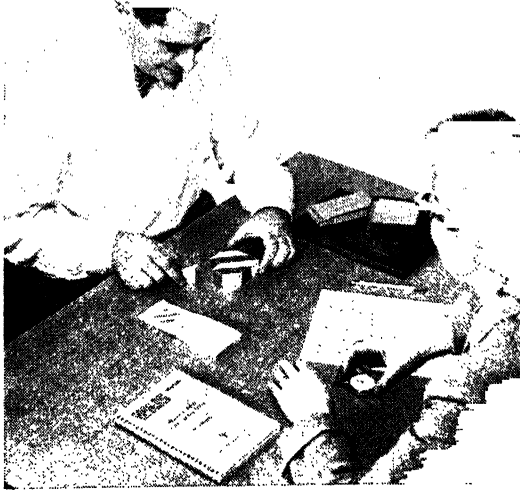
hand reactions are substituted for verbal reactions. Sometimes even the instructions are given without the use of speech. Performance tests include such tasks as *form boards*—boards with recesses into which the individual must fit blocks of the proper size and shape as quickly as he can—and *picture completion tests*, in which the individual looks at part of a picture and decides which one of several parts will fill in the blank to make the most sensible whole picture. From the scores obtained in such tests it is possible to derive children's mental ages. One of the best known tests of this type is the *Arthur Point Scale of Performance*, which includes several test items and is designed to test children from the ages of three to fifteen (Arthur, 1947).

For work with older children and retarded adults, most clinicians use another performance test—the *Cornell-Coxe Performance Ability Scale*. This is very similar to the *Arthur Scale*, and in fact includes many of the same subtests. In addition, it includes a test in which the subject is required to arrange a series of pictures so that they make a sensible story, a test in which the subject is to code a series of digits into symbols according to a

key, and other tests not calling for verbal skills (Cornell and Coxe, 1934).

A slightly different approach to nonverbal intelligence testing has been made in a recent study in which the ability to form concepts was measured (Hoffman, 1955). As we have seen, some individuals can best reveal their mental capacity through language, others through manual activities. The concept problems were designed for those whose highest level of mental attainment is revealed neither in verbal nor in manual responses.

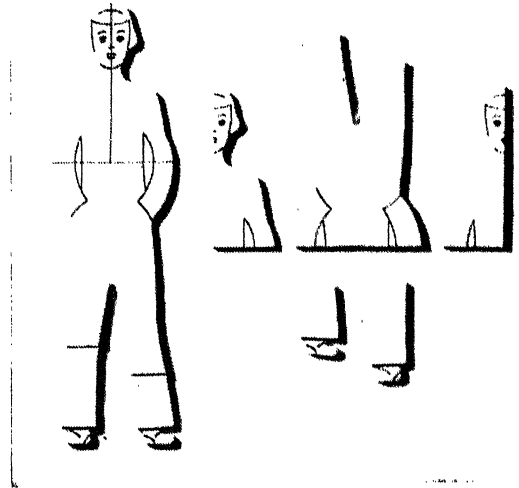
Seven series of paired cards were presented to three groups of subjects—subnormal, average, and superior adolescents. Each series tested a different concept. For example, Series I, shown in the illustration above, tested for the concept of size. The subject was shown a sample pair of cards in which the larger figure was marked on the back with a bit of red paper and was told that this was the "correct" figure. He was then asked to choose the correct one from the other cards. After each pair was shown, he was allowed to turn the cards over and see whether or not he had been right in his choice. Selecting the larger figure five times in a row meant that he had grasped the concept of size. The same thing was done for the concepts of regularity (symmetry),



In the Kohs Block Design Test the subject tries to reproduce a design by fitting together blocks whose six sides are all different. The test is made up of seventeen designs of graded difficulty, making it possible to test a very young child or an adult or an individual of any age in between and to assign him a point score on the basis of how far up the scale he can go. Shown here is part of an adult test.

depth, thickness, acuteness, and solidity (solid black versus outline figures). Regularity was the most difficult concept for all groups to grasp, and solidity was the easiest. Results correlated higher with verbal than with nonverbal intelligence test scores.

Wechsler-Bellevue Test of Intelligence. The Wechsler-Bellevue test combines the verbal and performance tests into one test designed primarily to measure the intelligence of adults. The test is set up in two parts—verbal and performance. The verbal section includes tests on information, comprehension, vocabulary, similarities between words, arithmetic, and digit span (in which the individual is tested to see how many digits he can repeat after the examiner has first said them). The performance section also has several parts: the Picture Completion Test, a shorter Kohs Block Design Test, the Object Assembly Test, the Digit Symbol Test, and the Picture Arrangement Test (Wechsler, 1944). At this time it is generally recognized that the



The Manikin is a part of the Object Assembly subtest of the WISC. The examiner arranges the pieces behind a screen in the positions shown at the right above. Then he tells the subject, "These pieces, if put together correctly, will make a boy. Go ahead and put them together." (The correct arrangement is shown at the left.) The time taken to complete this task is recorded, a maximum of 120 seconds being allowed. If the subject is still working at the end of this time, he is usually allowed to finish, but the examiner records the arrangement of the pieces at the end of the time limit. Scoring is as follows:

Perfect performance: 4 points or more [Bonuses are given for rapid performances on perfect arrangements.]

Legs interchanged, otherwise correct: 3 points

Legs inverted, otherwise correct: 2 points

Legs incorrectly placed as arms: 2 points

Legs omitted: 2 points

Only trunk correct: 1 point

Wechsler-Bellevue gives the most valid intelligence scores for adults of any test now available for use in clinical work.

The Wechsler Intelligence Scale for Children (WISC) is a similar test, with the same kind of subtests on a simpler level, except that a subtest on mazes (or coding, if preferred) is used instead of the Digit Symbol Test (Wechsler, 1949). Some of the simpler items from the adult scale are incorporated in the WISC.

The WISC differs from previous children's tests in that it abandons the concept of mental



The boy above is working the WISC subtest on mazes. With thirteen mazes of graded difficulty, it is possible to test a subject of any age above three and assign him a score on the basis of how far up the scale he is able to solve the mazes. The ability to make a clear plan and follow it through without false moves, an important component of intelligence, is required for successful solution.

age. This had been found to have certain disadvantages, especially in testing older children. On the WISC the subject's intelligence rating is computed by comparing his test performance with the scores earned by others of his own age group only. This means that the child's intelligence rating varies only when his test performance, as compared with that of his peers, varies. In other words, it represents his relative intelligence at his particular age.

In accordance with his concept of "global intelligence"—namely, that general intelligence is much more than "pure" intellectual ability but involves the personality as a whole—Wechsler attempted to take into account all the factors which contribute to intelligence.

FACTOR TESTS

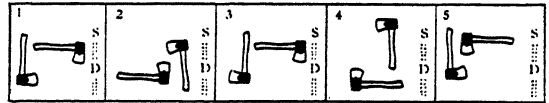
Modern research has shown that "general intelligence" is a term that refers to a complex group of "special intelligences," or *primary abilities*, which are relatively independent of

verbal: word meaning test

38 They looted and pillaged with *impunity*.

e. vigor f. safety g. difficulty h. speed....

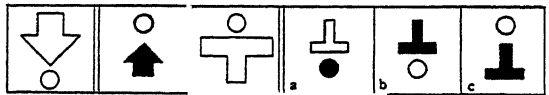
spatial: hatchets test



numerical: remainders test

Remainder									
13 ÷ 2,	1	2	3	4		16 - 9 = 6	7	8	9
	1	2	3	4			7	8	9

reasoning: figure changes test



The sample items above are from the Holzinger-Crowder Uni-Factor Tests, which measure four primary abilities—verbal, spatial, numerical, and reasoning. There are a total of nine tests, two for each ability except reasoning, for which there are three. In the *word meaning* test, one of the tests for verbal ability, the subject selects from four choices the word or phrase most similar in meaning to a stimulus word presented in context. In the *hatchets* test for spatial ability the subject determines whether two hatchets are viewed from the same side or from opposite sides. The *remainders* test for numerical ability includes short division and subtraction problems in which remainders must be indicated. As in the word meaning test, items are arranged in order of difficulty. In the *figure changes* test for reasoning ability the subject discerns the relationship between two figures and selects the figure that bears the same relationship to a third figure.

each other. These primary abilities are logical constructs. Although it is difficult to devise test situations which involve only one of them at a time, various primary abilities have been isolated and identified by a complex statistical procedure known as *factor analysis*. Factor analysis assumes that various kinds of human performance are determined by a relatively small number of functional unities, or *factors*.

The best known work in factor analysis is that of L. L. Thurstone, who pioneered in efforts to analyze general intelligence into its component parts (Thurstone, 1938). In one of

his experiments Thurstone administered to high school and college students a battery of fifty-seven tests designed to measure general intelligence. Every subject took every test. Correlating the scores on each test with those on all other tests, Thurstone was able to determine the extent to which various tests measured the same factor or ability. Any single factor discovered in more than one test was considered to be a *primary mental ability*. The general problem in the analysis of primary mental abilities is to discover the separate factors in a mixture or composite.

Among the most recent tests of primary abilities are the Holzinger-Crowder Uni-Factor Tests, sample items from which are shown on page 73 (Holzinger and Crowder, 1952). Dr. Karl J. Holzinger and his associates at the University of Chicago spent about twenty years in research, making repeated factor analyses involving many types of mental ability measures, in order to develop a "uni-factor" battery of tests. With these tests each of several factors can be measured directly by two or three tests having a high loading on the particular factor being measured and only small loadings on any other factors. Holzinger and Crowder measured verbal, spatial, numerical, and reasoning factors. Other investigators have isolated additional primary abilities, including perceptual speed and rote memory. Persons who score high on tests of general intelligence are usually high on all or nearly all of these primary factors, while those with low scores in general intelligence are low on all or nearly all primary abilities. Persons with average general intelligence, however, show a great deal of variation, often being quite high on a few primary abilities but low on others.

Unfortunately psychological testing was started on a hit-or-miss basis. Many "impure" tests were developed, but because they were found to work well for a particular purpose, they have continued in use. Furthermore, they have enabled us to collect a great deal of data that have been carefully analyzed. Psychologists hesitate to throw away or disregard this valuable backlog of information, and for that reason the pure factor tests have been slow in being adopted.

Factor analysis is being used today to isolate the basic factors composing many other complexes of human traits besides general intelligence. (See pages 531-535.)

OTHER TECHNIQUES OF MEASUREMENT

How can a standardized test be given or a numerical score be assigned for friendliness, adaptability, cooperativeness, self-confidence, or similar personality traits? Psychologists have developed a variety of methods that are especially designed to measure, as objectively as possible, those inner and outer aspects of personality. Some of these are well standardized, some are partially so, and some are quite subjective, as we shall see.

RATING SCALES

Obviously the easiest way to measure many personality traits is to ask a person's acquaintances what they think about him. This can be done systematically by means of *rating scales*, which are particularly valuable in assessing the social stimulus value of an individual. There are two kinds of rating scales, *relative* and *absolute*, each with certain advantages and disadvantages.

Relative rating scales. The order-of-merit method is typical of the relative rating scale. A judge ranks the subjects in order (1, 2, 3, etc.) by picking out the best and then the next best and so on until all subjects have been ranked on the trait being measured. This method indicates what each person's position is relative to that of all other subjects being considered. Its practical disadvantage is that the judge must keep the whole list of persons in mind throughout the rating process. This difficulty can be reduced somewhat by writing the names of the persons being ranked on cards and having the judge cast the cards into several piles as, for example, good, average, and poor. The judge can then put the names in each subgroup in rank order by laying the cards out on a table. This procedure will place the lowest of the good near the best of the average and the lowest of the average near the best of the poor. This permits some rearrangement between subgroups to get the final order.

Absolute rating scales. In absolute rating scales the judge assigns an absolute value or score to the trait being rated. Though this method is quicker than that of relative rating, it is subject to errors arising from the

The following factors are to be rated. The order in which these factors are listed in no way reflects their respective value.

DEPENDABILITY Your Confidence in Employee's Ability to Accept Responsibility	Refuses to or not able to carry much responsibility; needs constant follow-up.	Usually follows instructions; needs some follow-up	Willing and able to accept responsibility; requires little follow-up.	Outstanding ability to follow through on all assignments with no detail supervision.
QUANTITY Output - Speed	Exceptionally fast; unusual output.	Does more work than expected; is fast; exceeds requirements	Output meets acceptable standards; is satisfactory	Output below normal requirements; definitely slow.
ADAPTABILITY Versatility; Adjustment to Job or Changed Conditions; Ease with which New Duties are Learned.	Meets changed conditions with little effort; has outstanding ability to pick up new jobs.	Learns well with minimum amount of instruction; adjusts himself well in a short time.	Learns fairly well but needs detailed instruction for each new job.	Is slow to learn; has trouble adjusting himself to changed conditions; needs constant instruction.
JOB KNOWLEDGE Technical Knowledge of Job and Related Work, if applicable.	Has limited knowledge of his job;	Knows his job fairly well;	Seldom needs help; has good knowledge of his job; is well-informed.	Has excellent knowledge of his job and related work; is very well-informed.
QUALITY Accuracy in Work; Freedom from Errors	Makes practically no mistakes; highest accuracy.	Makes very few errors; is accurate; does high grade work.	Makes some errors but does passable work.	Makes mistakes frequently.

The above example of an absolute rating scale is used by the Lockheed Aircraft Corporation for a periodic review of its employees. The supervisor grades the work performance of each employee in reference to the level of accomplishment required on the assignments given him. Space is also provided at the bottom of the form for any additional comments the rater may wish to make.

"personal equation" of the judges. That is, some judges assign too many high scores; others give too many low or average scores. Furthermore, the standards of the individual judge may fluctuate throughout the series.

Because the rating scale depends so much upon the subjective judgments of the raters, it has often been regarded as inferior to the psychological test. Certainly the value of the ratings will depend both upon a judge's ability to appraise others and his definition of the traits being appraised. To some extent these factors can be checked, and the value of the rating scale thereby improved, by finding out how well two sets of judges agree on their ratings of the same individuals or by determining how closely the same set of judges agree on their ratings of the same individuals on successive occasions. Recent studies have indicated that with a skillfully constructed scale both of these potential sources of difficulty can be minimized.

In one study conducted by a large insurance concern with branch offices throughout the country, district office managers rated their personnel on various traits. The rating scale employed in this study was prepared with great care in an effort to eliminate the effect of the individual judge's ability to rate upon the validity of the results obtained. To minimize the effect of individual differences in ability to rate and thus to increase the validity of the scale, several improvements over ordinary rating methods were made: (a) for each trait to be judged, a larger number of alternative answers were provided from which to select the appropriate description for the individual being rated; (b) more detailed written instructions were given to the raters; (c) additional oral instructions were given to the raters; (d) personal supervision was provided while the raters filled out the rating blanks.

To test this scale, the office managers were in turn judged on their ability to rate by company field representatives. Thus for each rater a measure of rating ability was obtained. The raters were divided

into three groups on the basis of whether their rating ability was inferior, average, or superior.

Practically no difference was found in the general level of the ratings made by these three groups of raters; that is, the poor raters did not tend to be any more lenient or severe in their ratings than did the good raters. The ratings made by all three groups were of nearly equal accuracy, although the inferior raters did tend to rate more people as average and fewer people at the extreme ends of the scale. Thus by standardized use of a well-constructed scale, the effect of individual differences in ability to rate was greatly reduced, thereby increasing the validity of the rating scale procedure (Ferguson, 1947, 1949).

THE INTERVIEW

Undoubtedly you are familiar with the use of the interview by employers in selecting new workers. The interview is also used by clinical psychologists and psychiatrists in their attempts to study and treat personality disorders. Interviews are of two types. In the highly *standardized* interview, predetermined questions are asked in a certain set order. This method can be used by inexperienced interviewers, and its results are easy to score and evaluate; but it cannot be varied to follow interesting leads, nor is it likely to induce the person being interviewed to "open up" and reveal much about himself. The *informal* interview, on the other hand, though its results may be harder to evaluate, has the advantage of being less artificial and more easily varied to meet the needs of each individual case.

The "halo effect." One of the most frequent sources of error that prevents us from making objective judgments when using interviews and rating scales is the "*halo effect*." The judge cannot completely isolate the trait being rated from his knowledge of the individual as a whole. A person who is likable, or who is regarded as highly intelligent, will be rated high in other desirable traits. The best safeguard against this halo effect is to rate only one trait at a time. If a judge tries to rate more than one trait for the same individual at a single sitting, his earlier ratings are bound to influence his later ones.

Stereotypes. Closely related to the halo effect as a source of error in our estimates of personality is the effect of *stereotypes*. Stereotypes are preconceived notions as to how people of a given race, national origin, or

occupation ought to appear or behave. The stereotype of the Irishman, for instance, includes black hair and blue eyes, a cheerful sense of humor, and a readiness to fight at the slightest provocation. Many people have stereotyped mental pictures which immediately come to mind when they hear the terms "salesman," "spinster," or "scientist." Although many of these ideas have little or no basis in fact, they constantly influence our observations of people's behavior or appearance.

Reducing error in judging personality. Through training we can overcome some of our susceptibility to stereotypes and the halo effect and, in general, can improve our ability to judge human nature objectively. A striking example of how we can increase the accuracy of our observations of human behavior through practice is found in the following experiment conducted by a personnel director.

A class of thirty beginners was being trained for the work of interviewing applicants. The interviewers in training witnessed examinations conducted orally by a trained examiner. At the end of each examination of an applicant, the student interviewers were required to assign one of four possible ratings to the applicant interviewed. On the very first day of the experiment and before any instruction whatever had been given, the thirty students showed large variations in the ratings assigned to each of the applicants. At the end of two weeks training, however, the amount of agreement among the classes had increased enormously. Assuming that agreement was on the correct side, the conclusion is that the period of training had improved the ability of the subjects to observe and rate personality (O'Rourke, 1930).

These results are consistent with those of a more recent study in another area of human behavior. Four rater groups of varying experience (beginning psychology students, second semester abnormal psychology students, graduate psychology students, and Ph.D. clinical psychologists) were asked to judge the adjustment level of mental patients from ten short case histories (Bendig and Sprague, 1954). The results indicated that there was a general increase in reliability with an increase of educational attainment and related training.

THE SELF-INVENTORY

Standardized personal inventories avoid many of the disadvantages of rating scales and

interviews, for they require that the subject give the desired information about *himself*. He may be asked to tell what he likes or dislikes to do, what emotional reactions he tends to have in certain situations, whether he admires or condemns various figures in public life, and so on.

Sample items from the Guilford-Shneidman-Zimmerman Interest Survey are reproduced below (Guilford, Shneidman, and Zimmerman, 1948). This inventory lists 360 activities. The subject must decide whether or not he would like to engage in each of them and for what purpose. He can mark an item in one of four ways: with a D (DISINTERESTED in the activity, DISLIKE it, or DON'T KNOW); with an H (would like the activity for a HOBBY); with a V (would like the activity as a full or part-time VOCATION); or occasionally with both H and V.

110. Draw cartoons
111. Do some research in a library
112. Do a series of book reviews
113. Find a way to control a beetle that destroys crops
114. Use mathematical symbols and formulas to aid in thinking
115. Build a boat hull
116. Plan the layout of a production line in an automobile factory
117. Help to harvest a grain crop
118. Go skiing in the mountains
119. Plan business and commercial investments
120. Serve as a labor-union official
121. Sell wholesale merchandise to retail establishments against strong competition
122. Meet new people and get acquainted with them
123. Act as a guide or adviser to a newcomer
124. Distribute food to the needy
125. Look up data in files

Items in a self-inventory must always be checked against some outside measure of the trait they are intended to appraise. We can never be certain of the significance of a series of items or questions merely by looking at them. You might guess, for example, that newspaper editors like playing poker and dislike playing tennis—but could you decide on the basis of common sense that life insurance salesmen, as a rule, dislike museums and like educational movies? Nevertheless these are typical reactions, based on the responses of many men in these professions.

The self-inventory blank is valuable in that it goes below the surface to tap the individual's own personal experience and feelings. It is also convenient to give because it does not require the services of a group of raters or interviewers. Its chief disadvantage is that the person tested does not altogether understand himself and therefore cannot always give an accurate report. Or, if he wishes, he can easily lie about himself in an attempt to make the results look more favorable. As we shall see in Chapter 17, the self-inventory method, carelessly used, has often been disappointing as an instrument for selecting personnel in business and industry. In careful hands, however, it works well as a device to aid in evaluating applicants for employment or candidates for promotion. It has also been valuable in clinical guidance situations, where the individual usually wants to gain greater understanding of himself and therefore answers questions about himself honestly.

BEHAVIOR SAMPLING

In behavior sampling, actions rather than words are most significant. Instead of depending upon what others say about a person or what the person says about himself, the examiner actually observes the person's behavior in a typical situation. Unaware that he is being watched, the subject acts naturally.

An example of behavior sampling is the following test of honesty. A teacher asks his students to perform a task "on their honor" and then leaves the room, giving them ample opportunity to cheat. A few days later the same task is assigned, but this time the teacher maintains close supervision. A student who does well without supervision but performs poorly under supervision may likely have cheated the first time. This procedure is repeated with a variety of tasks on different occasions so that the investigator can get a reliable total score in terms of the number of times the student cheated. The purpose of these tests is not to trap the students (nothing is ever said or done to the probable cheaters), but to obtain a measure of honesty in a specified situation.

PROJECTIVE TECHNIQUES

Undoubtedly you have sometimes "seen" a face or the shape of an animal in a cloud. But



The behavior sampling technique was used in a special project set up by the OSS during World War II to devise tests for selecting leaders who would show calmness and resourcefulness under stress. Situations were set up which were as nearly as possible like those that a candidate might actually meet. One situation (left) involved an assignment to complete a piece of construction, supervising men who, unknown to the candidate, had instructions to sabotage the effort. None of the candidates was allowed to finish the construction. In another situation (right) the candidate was mercilessly grilled in an attempt to detect flaws in a cover story which he had been given only a few minutes to invent.

if you mentioned this to a friend, you may have discovered that he saw a tree or a house or something else quite different. Psychologists rely upon a similar phenomenon in their use of *projective* or *depth* techniques of personality measurement. The subject is presented with a standardized set of ambiguous or neutral stimuli—inkblots or pictures which have no definite meaning but can be interpreted in various ways—and is allowed to interpret freely what he “sees” in them. Thus the subject can “project” into each neutral stimulus some special, private meaning—much as you projected the face or animal into the cloud. Psychologists have found that such projections reflect the differing needs and emotional adjustments of individuals and thus help reveal underlying personality patterns.

Projective tests are difficult to fake because there are no obviously “right” or “wrong” answers. They have the further advantage of tapping deeper levels of needs and fears than other measurement methods. Their chief limitation is that the psychologist must rely to a large extent upon his own subjective judgment in scoring the subject’s responses. Although objective standards have been set

up for evaluating various types of responses, without skillful interpretation on the part of the examiner the results of projective tests are valueless.

The Rorschach Test. The Rorschach technique, one of the oldest projective methods, makes use of a series of inkblots. Some are black and white, some colored, but all vary in form, shading, and complexity. The subject observes the cards in order and tells what he “sees” in each inkblot. This test often gives information about the personality structure which cannot be brought out by clinical interviews. For example, the way subjects react to the color in the blots may throw light on their emotional responses to their environment.

Separate scores are made of what the subject sees on the card, where he sees it, and what qualities of the blot caused him to see it. Thus the interpretation of a Rorschach record is highly complex, based on many variables and never on one or two responses alone. This means that it must be used only by workers who have had a very specialized and prolonged training.

Proper evaluation of the Rorschach usually

requires at least two operations: (1) the *performance proper*, in which the subject is allowed to give his spontaneous reactions to the cards without interruption; and (2) the *inquiry*, in which the experimenter goes back over the subject's responses and questions him about how he arrived at each of them. Sometimes it is even necessary to add a third step known as *testing the limits*. Here the experimenter asks additional specific questions about points that were not clarified during the inquiry (Klopfer and Kelley, 1946).

A number of studies have been made to test the accuracy of the Rorschach technique in diagnosing personality disorders.

One study was designed to determine how much agreement would be reached between psychologists judging a group of subjects from Rorschach test results and psychiatrists judging the same subjects from clinical case material. A group of fifteen subjects—including normally adjusted persons, neurotics, and psychotics—was used. Ten qualified psychiatrists judged each subject for overall adjustment on the basis of clinical material. Ten skilled psychologists judged each subject for overall adjustment on the basis of (1) Rorschach test results and (2) clinical material.

In their findings based on the study of clinical materials, the psychiatrists and psychologists showed a high level of agreement, both within their own groups and with each other. There was also a high level of agreement among the psychologists in their interpretations of the Rorschach results. When these findings were compared with those which they and the psychiatrists had made on the basis of clinical materials, however, almost no agreement was found. In addition to disagreeing with the clinical findings of both groups, the Rorschach results failed to distinguish adequately the placement of subjects into the categories of normal, neurotic, and psychotic (Newton, 1954).

To test the ability of the Rorschach test to describe an individual's personality, two studies were made comparing Rorschach results with the ratings of the same subjects on a validated test called the Index of Adjustment and Values. The Index is designed to measure a person's concept of self, acceptance of self, concept of the ideal self, and maladjustment.

In the first study only one of these four measures was tested—acceptance of self. It was held that people who rate high in self-acceptance will have



The girl above is telling the experimenter what she "sees" in the Rorschach inkblot.

different personality characteristics than people who rate low and that the two groups should therefore have different Rorschach results. Fifty college students were used as subjects. According to the Index twenty-five of them rated high on acceptance of self and twenty-five rated low. These same subjects were then tested with the Rorschach and results were compared. It was found that the two groups, according to their Rorschach scores, were distinctly different personality groups and that the Rorschach successfully distinguished subjects who were high in self-acceptance from those who were not (Bills, 1953).

The second study tested the hypothesis that people who have only a small discrepancy between their self-concept and their concept of the ideal self (sometimes called a measure of personal level of aspiration) will show fewer signs of depression on the Rorschach than people whose level of personal aspiration differs widely from their concept of self. Fifty-six college students were rated on the Index of Adjustment and Values and divided into two groups, one with a high and the other with a low level of discrepancy. Each subject was then tested with the Rorschach. Certain characteristics of Rorschach results, such as the total number of responses made and the time taken for each response, have been thought to indicate depression. Of the six signs considered to be indicators of depression, five proved valid in distinguishing the two groups. It was concluded that persons who have a high discrepancy between their concept of self and their concept of

the ideal self—that is, who have high levels of personal aspiration—show more Rorschach signs of depression than people with low levels of personal aspiration (Bills, 1954).

Like those cited above, other recent studies have been somewhat contradictory in their findings about the value of the Rorschach in measuring personality. One interesting experiment indicated that a person who responds in a “rigid” or “flexible” manner to the Rorschach will tend to respond similarly in other perceptual situations (Johnson and Stern, 1955). Thus this experiment indicated that the Rorschach may be a valuable technique for studying perceptual processes. Less positive results were found by another recent study which tested the value of the Rorschach in predicting the treatment outcome of patients undergoing psychotherapy (Filmer-Bennett, 1955). The conclusion here was that, with our present state of knowledge, this technique alone is not at all an adequate predictor of how a patient will react to treatment.

Validation of the Rorschach test is difficult and introduces problems not ordinarily en-

countered, since statistical methods for such tests have not yet been developed fully. One extensive examination of studies involving the Rorschach test led to the conclusion that errors and unsound statistical procedures used in validating the Rorschach were so widespread that perhaps 90 per cent of the conclusions published are unsubstantiated (Cronbach, 1949). This does not mean that these studies are necessarily untrue but merely that they are not of proven validity. There is, however, enough encouraging evidence in favor of the Rorschach that it deserves further attention as a promising technique of personality study.

The Thematic Apperception Test (TAT).

Another example of the projective technique is the Thematic Apperception Test (Morgan and Murray, 1935). This test is composed of three series of ten pictures, each picture representing a different situation. The subject is asked to make up a story about each picture, describing the situation, the events that led up to it, how the characters felt, and what the outcome will be. By evaluating (1) the formal characteristics of the subject's stories and (2) their content, the examiner tries to discover the thought content of the subject.

In evaluating the formal characteristics of the stories, the clinical interpreter looks for the presence or absence of *interindividual* and *intraindividual* consistency. An example of lack of *interindividual consistency* would be when a particular subject regards a figure whose face cannot be seen in the picture as a woman, while most people regard the same figure as a man. An example of lack of *intraindividual consistency* would be a case in which a subject who has given a full background of events in all the other stories suddenly avoids doing so. Such inconsistencies are considered significant clues, and the reason for them must be sought.

One recent study has indicated that persons who tend to be dependent—that is, who seek the help of others in making decisions and who fear loneliness—tell TAT stories quite different from those told by independent individuals.

Twenty-seven psychology students served as subjects. After they had written brief TAT stories, they were tested for dependency (as indicated by tendency to conform to group opinion) in an experimental



Above is one of the pictures used in the Thematic Apperception Test.

situation in which they had to judge the correct length of certain lines. The subjects were led to believe that this was an entirely different experiment from that with the TAT. In judging the lengths of lines, each subject worked in a group with four other men. These were all "stooges" who had been instructed by the experimenter to express an incorrect opinion when they judged some of the lines. The TAT subject was always the last of the group to be asked his opinion. His degree of dependency was measured by the number of times he yielded to the group opinion on the incorrect judgments. Results indicated that every one of the subjects who had told two or more TAT stories in which a principal character sought help from others, or was disturbed by lack of love and support, was a "yielder" in the conformity experiment (Kagen and Mussen, 1956).

A card showing a young man and an older man talking was the one about which stories with themes of dependency were most frequently told in this experiment. One story typical of those told by the yielders was the following:

"Bill Johnson was troubled over a problem that he had concerning his girl friend. He spent considerable time pondering on the problem but could think of no logical answer. Finally he sought the help of his father. They talked about the problem for a while and finally the old gentleman arrived at a conclusion. Bill applied the resulting conclusion and found his problem was solved" (Kagen, 1957).

Many of the nonyielders, on the other hand, saw the two figures as criminals planning a crime or as a lawyer and his client. Very often feelings of hostility between the figures were described, as in the following typical non-yielder story:

"These two people are having an argument about the business in which they are father and son partners. The father has old ideas about doing things and the son has modern methods which he picked up in college. Obviously the partnership will not work because of this. The son still holds high regard for his father but refuses to accept his father's ways of doing business. The father still thinks that a plan can be worked out, but through his higher education the son realizes the impossibility due to the business method disagreement" (Kagen, 1957).

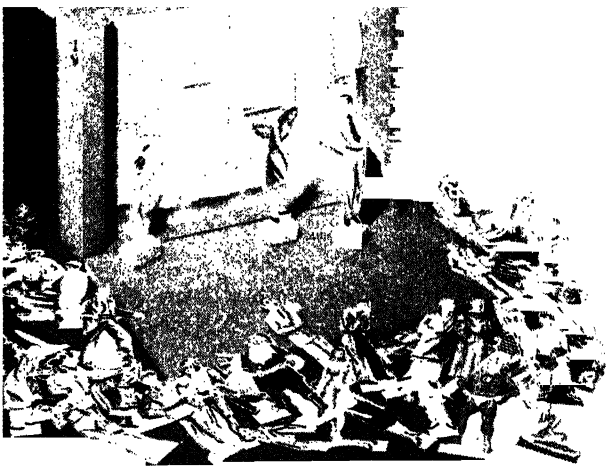
Another recent study bears out the assumption of clinicians that in the TAT the individ-

ual constructs stories around ambiguous pictures by drawing on material from his own experience. This was an investigation of the contents of the TAT stories given by a group of Negro and white children.

Fifty Negro and fifty white boys of lower class status were selected as subjects. They ranged in age from nine to fourteen. Results indicated many significant differences between the Negro and white boys' responses to the TAT. The Negro group saw the general environment as more hostile and indulged in more verbal aggression and hostile thinking than the white boys, but their aggressions took a milder form. The Negro subjects rarely saw themselves as establishing and maintaining friendly relations, respecting others, being respected by others, being kind or considerate, or being followed or obeyed by others. The interpreter felt that the Negro boys' general perception of a hostile and threatening world affected their infrequent use of extreme forms of aggression as well as their relative lack of responses indicating a striving for accomplishment and success. On the whole they put more emphasis on passive pursuits such as thinking, reflecting, and speculating (understanding).

The white group, on the other hand, considered the world more warm and friendly. More of their heroes were leaders and respected individuals. They showed greater interest in establishing and maintaining friendly relations and in being kind and considerate of others. The conclusion of the interpreter was that since the white group felt more secure in the world, they felt freer to strive for achievement, to verbalize their extreme hostilities, and to defend themselves against aggression. Though generally more secure, the white boys nevertheless showed more feelings of rejection in the family, especially by their mothers, than did the Negroes. It was felt that this might partially account for the more extreme hostile attitudes found in the white group. The greater feeling of family security among the Negro boys might result from the customarily permissive treatment of young children by lower-class Negro mothers.

This study indicated that individuals belonging to different social groups and subject to different cultural pressures will show consistent and major differences in their responses to projective tests such as the TAT. Although responses of a certain kind might be considered unusual if given by a member of one sociocultural group, the same responses might be perfectly normal if given by a member of another group. It was concluded, therefore, that the unusualness of projective responses must be evaluated in



The stage, backdrop, and characters shown above are used in the Make a Picture Story Test.

terms of the subject's cultural background and group membership (Mussen, 1953).

Evidence such as that reviewed here indicates that the Thematic Apperception Test has the potentiality of being a valuable aid in studying personality. On the whole it seems a more promising technique than the Rorschach, but like any projective test it depends for its value on the experience and skill of the interpreter. It is as yet a dull tool.

The Make a Picture Story Test (MAPS). For this test the examiner presents the subject with a tiny stage and a series of backdrops, including bedroom, living room, bathroom, street scene, cemetery, life raft, and others



The symbols shown above are used in the Kahn Test of Symbol Arrangement.

(Shneidman, 1952). As each backdrop is presented, the subject is asked to choose one or more characters from a large group of cutout figures (consisting of men, women, animals, and legendary and fictitious figures, even including Superman) and then to place his chosen figures in position against the background and tell the story of the situation he is depicting. This test is similar to the Thematic Apperception Test, except that the subject has greater freedom of expression since he is allowed to choose and place his own characters. This device has the advantage of greater objectivity than the other projective techniques, but its true value remains to be determined.

A somewhat different type of projective test, which involves projection of personal needs into culturally structured symbols, has been used extensively in the United States Air Force. This is the Kahn Test of Symbol Arrangement, shown in the picture below, left (Kahn, 1955). In this test the subject is asked to tell what each symbol means to him and to arrange the symbols on the numbered squares of the felt strip in various ways. Although many of the symbols, such as the heart and the anchor, have rather definite meanings in our culture, the subject's arrangements, as well as his verbal account, can reveal much about his underlying desires and fears to a skilled interpreter. While much research remains to be done on this relatively new test, it shows promise of being a useful tool in revealing personality disturbances.

There are many other projective tests which cannot be discussed in detail here for lack of space. Among these are: The Incomplete Sentences Blank, the Word Association Test, the Rosenzweig Picture-Frustration Test, and the Bender-Gestalt Test. For a critical examination of this important aspect of psychology, the interested reader is referred to a recent textbook in clinical psychology (Rotter, 1954).

THE PSYCHOGRAPH

The *psychograph* is a chart or "profile" showing the individual's standing on a group of traits, as objectively measured or rated. It is made by employing some of the statistical techniques that will be discussed later in this

chapter. Such a profile shows at a glance the areas in which a person is above average and those in which he is below average. It thus enables us to study the individual not only in comparison with other people but also in terms of the relative strength and weakness of various traits in his own personality.

The psychograph shown below represents one student's temperament pattern, as revealed by a self-inventory which measures ten outstanding traits associated with temperament (Guilford and Zimmerman, 1949). These traits are listed at the side of the psychograph, and the student's standing on each trait is indicated in terms of a centile score (see page 87) by a dot at the appropriate point along the horizontal line extending from the trait name. The dots are connected by straight lines to produce a "profile" of the temperament pattern. Thus we see that this individual is a sociable, outgoing, aggressive person who is not particularly reflective.

A glance at a psychograph of a temperament pattern, like that shown below, gives a better picture of the total personality than could be obtained from considering individual traits one at a time. For example, a person very high in ascendance (or social dominance over others) and at the same time high in friendliness would have a vastly different personality than the person who was equally dominant but very low in friendliness. Certain groups of traits in a certain pattern may be more important for success in a particular vocation than high scores in a few individual traits. Hence profiles are often used by employers to provide a picture of the strengths and weaknesses of their employees or pro-

spective employees. Educators and clinicians also find profiles helpful. Depending on the purpose for which it is going to be used—whether as a measure of temperament, interests, or abilities—a psychograph may be worked out to show any combination of personality traits.

But such a profile does not show the way in which two or more traits may work together to determine how a person will react. For example, the profile illustrated here shows that the individual is sociable, outgoing, aggressive, and not particularly reflective. These traits may work together to produce a person who acts before he thinks, but this cannot be discerned just from the profile.

STATISTICS IN MEASUREMENT

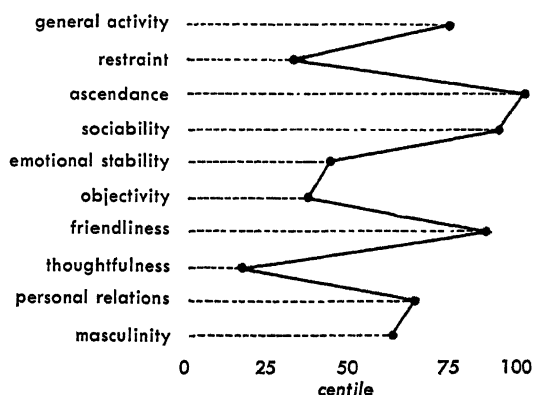
The science of statistics is a standard method for collecting, organizing, and interpreting numerical information. In personality measurement statistical procedures simplify complex data and permit rapid comparisons to be made between individuals and groups.

Though there is a tendency to think of statistics as too complicated for the "ordinary mortal," we often use statistical concepts in everyday life. One of the most typical and most widely used statistical measures, for example, is the *average*, technically known as the *arithmetic mean*. We all realize that to answer such questions as whether men are more intelligent than women it is necessary to compare their average intelligence rather than the intelligences of isolated men and women. Most other statistical devices serve the same essential purpose of helping us get away from single measurements, which might be misleading, to a more general picture. They help us avoid the all too common error of assuming falsely that a particular individual or event is "typical" and a representative example of the group as a whole.

UNITS OF MEASUREMENT IN PSYCHOLOGY

Quantitative test results have practical value only when comparisons can be made between the performances of different indi-

Psychograph of a Temperament Pattern



viduals on the same test or between the performances of one individual on different tests.

Interpreting raw scores. The numerical score earned on a test means nothing in itself. If you make 98 points on an arithmetic test and only 50 points on a vocabulary test, you are not necessarily justified in saying that you are better at working problems than at defining words—there might be more items in one test than in the other, or the items of one test might be more difficult than those of the other. Before comparing your performance on the two tests it would be necessary to convert these arbitrary scores, called *raw scores*, into common terms. There are several ways of doing this, but first it is necessary to become familiar with a few basic concepts used in measurement statistics.

The need to establish a point of origin. In measuring personality, just as in measuring other things, we use a numerical value to represent *degrees* of something. This always implies that the individual is so many degrees above or below some certain point. When we look at a Fahrenheit thermometer and see that the temperature is 75 degrees, we know that this means 75 degrees above the zero point, which has been arbitrarily designated at 32 degrees below the freezing point of water. But just approach a resident of North Dakota in January and ask him if zero represents the lowest point on the thermometer! Thus, in such a relatively simple measuring instrument

as the thermometer, zero (or the point of origin) has been set at a point that does not represent the complete absence of heat.

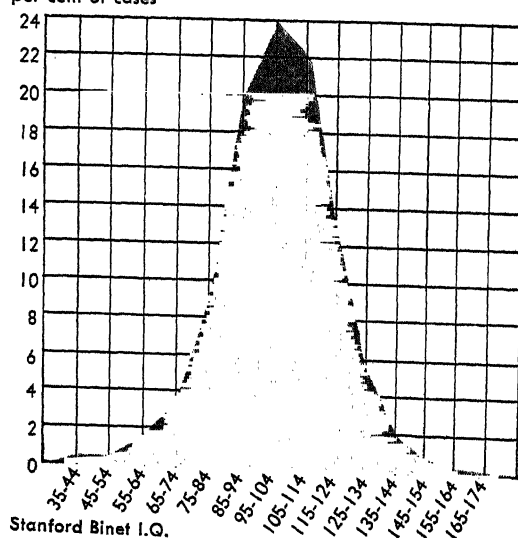
It is impossible to determine a point on test scores that would represent "zero ability" or "zero amount" of a trait. For instance, a backward child might make a numerical score of zero on a test designed for superior adults, but this would not mean that he had no ability. Because of the practical difficulties involved in determining a zero point, psychologists have given it up as a basis for comparing test scores. Instead they use a different point of origin for scores, based on their study of *how traits are distributed in the population*. Thus an individual can be scored on the basis of how much *more* or *less* of a trait he has than the average person. The psychologists' methods for determining a point of origin are discussed below.

DETERMINING TRAIT DISTRIBUTION

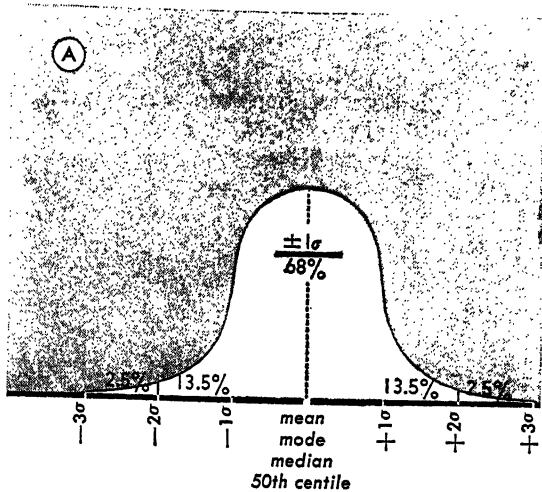
As we saw earlier, traits are not "all-or-nothing" characteristics. Individual differences do not depend on the presence or absence of certain traits but rather on their being present in varying amounts in different persons. Of special interest to psychologists is the fact that most traits—both biological and psychological—seem to be distributed symmetrically in the population. For example, if we should measure a large group of people of the same sex and age for the physical characteristic of height, the individual measures (or "scores") would range along a continuous scale from that of the shortest person to that of the tallest. If the group were typical, there would be a few extremely short people and a few extremely tall ones, but most of them would be about average in height. If we should plot the heights of such a group on a graph, we would find that the number of cases concentrated heavily around the middle and tapered off toward both the upper and lower extremes. Our graph, then, would take the form of a roughly "bell-shaped" curve, such as that shown below left. Such a curve represents what we call a *normal distribution*.

The bell-shaped curve may be relatively broad and flat, as shown in Curve A above, or high and narrow, as shown in Curve B—depending on the extent to which individual cases are concentrated at the center. Regard-

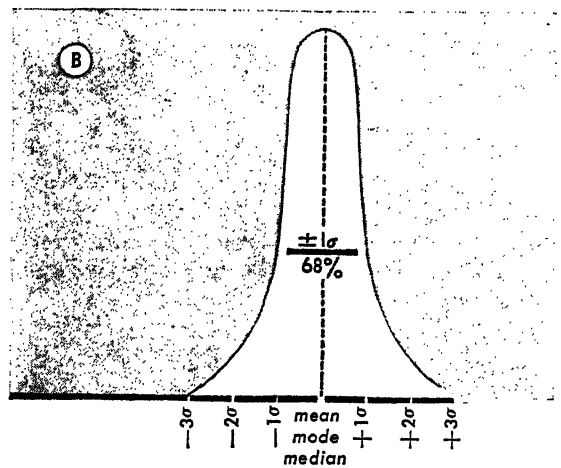
Distribution of Intelligence among
2904 Unselected Children, Ages of 2 to 18
per cent of cases



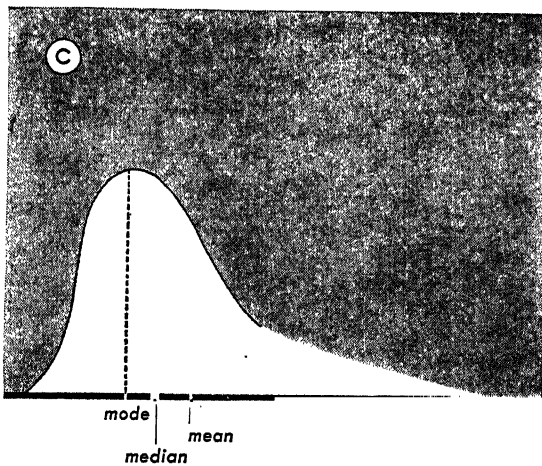
Normal Curve with Wide Spread



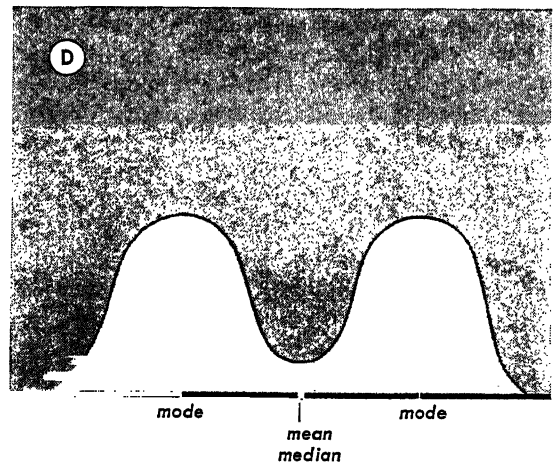
Normal Curve with Narrow Spread



Skewed Curve



Bimodal Curve



less of the degree of concentration, however, approximately the same number of people will usually fall below the middle group as above it. Furthermore, since people tend to cluster about the middle of the distribution, individual differences in a given trait are usually small. The further an individual is from the average—either above it or below it—in respect to a given trait, the fewer people there will be in the population as a whole who possess a like degree of that trait.

Nearly all traits have been found to be distributed according to the normal, bell-shaped curve. One of the most persistent errors in popular thinking is the notion that people are sharply divided into two groups with respect to many traits. People are re-

garded as introvert or extrovert, musical or not musical, smart or "dumb," and so forth, but like most other popular "either-or" judgments, such concepts are inaccurate. People who possess a very large or very small degree of any trait are rare.

Cases in which traits cluster about two extremes, giving a "bimodal curve" of the type shown in Curve D, are extremely rare. A "skewed curve" like Curve C above, in which the majority of cases cluster about a point below or above the middle, often indicates that a poor sample was used in the study. Some factor of bias in the selection of the group may have caused nearly all the members to be relatively low in the trait measured (if the curve is skewed to the right like Curve

C) or relatively high. Thus the sample group is not truly representative.

Lacking a true zero point in his measuring scales the psychologist must use another *point of origin* from which to make meaningful interpretations of his measurements of personality traits. To understand how he determines this point of origin, we must consider two more important statistical concepts used to describe distributions. These are: *measures of central tendency* and *measures of deviation* (or *spread*).

Measures of central tendency. The familiar "average" or *arithmetic mean*, is perhaps the best known measure of the *central tendency* of a group. By determining an individual's position in relation to this or another measure of central tendency, we can make more meaningful statements about his abilities. To obtain the arithmetic mean we add all the scores of the group of individuals tested and divide by the number of scores.

Psychologists and other social scientists make frequent use of two other measures of central tendency: the *median* and the *mode*. The *median* is the middle score of the group, the score which separates the upper half of the cases from the lower half. The *mode* is the score earned most often by members of the whole group being studied.

Study the list below to make certain you understand the three most common measures of central tendency. This list gives the scores earned by fifteen fictitious students on a test of reasoning ability. The scores are arranged in order from the highest to the lowest to simplify working with them.

Name of Subject	Score	Name of Subject	Score
E.I.N. Stein	32	Ava Rage	20
I.Q. Super	30	O.R. Dinary	18
A. Topping Braine	28	Ima Dope	15
N.T. Lect	26	Flossie Flutterbrain	14
Farley Sharpe	25	Watt A. Goon	11
Will Dooh	22	M. T. Heade	10
F. Ayre	20	Moe Rahn	9
Mead E. Ochre	20	Total	300

To obtain the *arithmetic mean* we divide the total of scores, 300, by the number of scores, 15, giving 20.

In studying the list we observe that the score of 20 was obtained by three students. The *mode* of the distribution is therefore 20,

since that score was earned more often than any other.

Of the fifteen scores the middle one would be the eighth, that of Mead E. Ochre. This score, 20, is therefore the *median*, since it falls at the midpoint of the distribution.

In this example all three measures of central tendency turned out to be the same score, 20, and you may be wondering why we don't just use the mean in the first place without going to the trouble of figuring out the other two. It is true that in normal distributions made up of a large number of scores the three measures of central tendency generally will have almost identical value, but this does not always happen. A few very high scores, for example, can cause the mean to be much higher than the other two averages. A few very low scores could have the opposite effect. For this reason the mean is not always the best measure of central tendency. Consider, for example, the following scores.

Subject	Score	Subject	Score
A	92	I	20
B	90	J	18
C	58	K	15
D	26	L	14
E	25	M	11
F	22	N	10
G	20	O	9
H	20	Total	450

The arithmetic mean is now 30, which is hardly typical of the scores as a whole, since all but three of them are below 30. In skewed distributions like this, where the scores pile up toward one end of the distribution rather than in the middle, the median or the mode (in this case, each still 20) is a more useful measure of central tendency than the mean.

Measures of deviation. The measure of central tendency provides us with a *point of origin* for measuring traits. We determine, not how much more of a given trait an individual has than the zero amount of that trait, but how much more or less of it he has than the *average* (mean, mode, or median) of his fellows.

We still have the problem of determining accurately just how far above or below this average the individual is. We do this by measuring his *deviation from the central tendency*. Though this is done in several ways, the

two most important methods are by determining *centile scores* or *standard scores*.

Centile scores provide the simplest method of assigning a person to an exact position on a trait scale. The word *centile* means a cut of one one-hundredth. The 99th centile, for example, is the point below which 99 per cent and above which 1 per cent of the cases are found. The median is the 50th centile—50 per cent of the cases are below this point and 50 per cent above it. When raw scores are converted into centile scores, as was done in the psychograph on page 83, we can tell at a glance what percentage of persons in the group fall below and how many above him in performance. A student's centile score can tell him how he compares with other members of his own particular class or, on certain standardized tests, how he compares with much larger groups all over the country. Lists of raw scores with their corresponding centiles based on large groups are known as *norms*. Centiles are sometimes referred to as "percentiles," but this term is incorrect and is gradually dropping out of use.

Standard scores are also figures which indicate a person's position in the distribution. Look again at Curves A and B, page 85. Both are normally distributed and both might have the same mean, mode, and median, but the total picture is quite different in the two cases because in Curve A the spread is so much wider.

The most commonly used indicator of spread is the *standard deviation*—often written as σ and called *sigma*. The standard deviation represents a certain distance along the base line of a distribution curve, and the *numerical value* of the standard deviation tells us how closely the cases cluster around the mean. In a normal distribution, 68 per cent of the cases fall within one standard deviation above or below the mean, written as $\pm 1\sigma$ (plus or minus one sigma); 95 per cent fall within $\pm 2\sigma$; and almost 100 per cent within $\pm 3\sigma$. This is true in both Curves A and B. But because a small spread signifies a small sigma, we can assume that the numerical value of sigma is smaller in Curve B than in Curve A (if both curves represent distributions of different groups on the same test).

While you are a beginning student in psychology you probably will never have to calculate a standard deviation, and there is no

need to memorize just how it is done. By working out an example, however, you may gain a better understanding of what standard deviations mean and how they are used. Taking the group of student scores listed on page 86, you can calculate the numerical value of the standard deviation as follows: Write down how much each score differs from the mean and find the square of that figure. For instance, among the fictitious students above, E.I.N. Stein's score was 12 points above the mean, giving us 144 as the square of that difference; for I.Q. Super the score is 10 points above the mean, giving a square of 100, etc. When you have squared all the differences, find *their* arithmetic mean and then take the square root of that mean. If you have been persistent enough to carry this process through to the end, you have arrived at an answer of 7, which is the *size* of the standard deviation for this distribution.

On the basis of the standard deviation we can compute the *standard score* for any individual in the group. To do this we find the difference between the raw score and the mean and then divide this difference by the standard deviation. We have seen that the difference between E.I.N. Stein's score and the mean was 12. The standard deviation of that distribution is 7. Dividing 7 into 12 we obtain +1.71 as Stein's standard score. Moe Rahn, at the other end of the list, obtains a negative standard score, since the difference between his raw score and the mean was -11. His standard score is -1.57. Those whose raw scores were 20, the same as the mean, would have standard scores of zero.

Standard scores indicate clearly where each individual stands in relation to the average of the group. Standard scores are particularly valuable to psychologists because scores on one test may readily be compared with those on other very different tests to obtain a clear picture of an individual's strengths and weaknesses. For example, when we want to know whether a person is better in arithmetic than he is in spelling, we cannot compare his raw scores directly but must convert them both into standard scores.

To avoid the complications of working with zero and negative scores in making such comparisons, the standard scores are often modified. One of the most common methods is to multiply by 10 and add 50. Application of this procedure to the above figures would

yield 67 for Stein and (rounding -1.57 to -1.6) 34 for Rahn. Standard scores modified in this way are called *T scores*.

Variance. For some purposes psychologists and statisticians use a measure known as *variance*. This is computed in the same way as a standard deviation except that the last step is omitted. In computing a standard deviation (page 87) you added the squared differences between each individual's score and the mean, then divided this sum by N (the number of cases), and finally took the square root of this answer. In computing a *variance* you follow the same process but *stop* before taking the square root. The variance of the scores listed on page 86, for example, would be 49; the standard deviation (or square root of variance) is 7.

Variance is usually represented by the symbol σ^2 . Actually, of course, you must find variance before you can know the value of σ (standard deviation); but since the mathematical value of variance is identical to σ^2 , statisticians use this as a convenient symbol.

The concept of variance is helpful to psychologists because variances caused by different conditions can be added or subtracted meaningfully, whereas standard deviations cannot. In any test, for example, the variance of the total score-distribution is equal to the true variance plus the variance caused by errors of measurement.

THE CORRELATION COEFFICIENT

It is often valuable to know whether or not traits go together (co-vary). Are intelligent persons more friendly, more mechanically minded, or taller and stronger than less intelligent ones? To answer this question we would first measure a group of people in intelligence and in whatever other traits concerned us and then see to what extent the intelligence scores were related to—that is, correlated with—the scores in other traits.

When we speak of correlation, we mean the *average* relationship found between two traits in a group of people. If we found, for instance, that tall people were usually higher in intelligence than short ones, we could say that there was a high correlation between height and intelligence. If the two traits correlated *perfectly* and *positively*, we could line up all the individuals of the group according to height and find that they were also lined

up perfectly according to intelligence. If we found that intelligence was greater in short people and decreased with height, we would say the correlation between the two traits was *negative*. If tall people were neither more nor less intelligent than short ones, we would say there was no correlation between the two traits, meaning that knowing a person's height would give us no clue to his intelligence.

The exact mathematical correlation between two sets of scores is called the *coefficient of correlation*, or *r*. It is obtained by multiplying each person's deviation from the mean on one test by his deviation on the other test, adding all these together and dividing by the number of cases times one standard deviation times the other standard deviation:

$$r = \frac{\sum x \cdot y}{N \cdot \sigma_x \cdot \sigma_y} \text{ or } \frac{\text{sum of cross-products of deviations}}{\text{number cases times } \sigma_x \text{ times } \sigma_y}$$

The correlation coefficient is never more than $+1.00$ or less than -1.00 . A result of $+1.00$ would mean that there was perfect positive correlation between the two groups of scores; -1.00 would indicate perfect negative correlation. If two tests were perfectly correlated, either positively or negatively, it would mean that if we knew a person's score on one test, we could predict his score on the other with perfect accuracy. But perfect correlations are almost never found.

Using the correlation coefficient to predict. Having obtained the correlation coefficient, you may wonder just how it can be used for prediction purposes. Suppose, to continue with our example, that we wish to predict an individual's success in vocabulary when we know that he made an above average score in spelling. Having followed the process described on the opposite page, we obtained a correlation coefficient of $+ .87$. The correlation coefficient is *not* read as a percentage, but it is helpful to translate it into a percentage for prediction purposes. In other words, we ask the question: what percentage of students who make high spelling scores will also make high vocabulary scores when the correlation coefficient of the two abilities is $+ .87$? If the correlation coefficient were $+1.00$, as we have seen, 100 per cent of students who made high spelling scores would also make high vocabulary scores. If the coefficient were zero, meaning that there was no relation between the two abilities, 50 per cent of the students making spelling grades in the upper half of

Hypothetical Correlations

In the table at right are the scores of ten boys on a spelling test and a vocabulary test. The mean and standard deviation (σ) for each group of scores are given at the bottom of the table. (For methods of calculating see pages 86-87.)

The table also shows how much each boy's score deviates from the mean. For an example of how you would arrive at these deviations, look at Allen's spelling score. Since Allen made a score of 20 and the mean of all spelling scores was only 9.4, his deviation on the spelling test is 10.6. Notice that when a score falls below the mean (as, for example, Arthur's does on the spelling test), the deviation is expressed as a *minus*.

To find the correlation between the spelling and vocabulary scores obtained by these boys, apply the formula on page 88, following these steps. (1) Multiply each boy's spelling deviation by his vocabulary deviation:

	Spelling	Vocabulary	
Allen	10.6	\times 27.4	= 290.44
James	8.6	\times 19.4	= 166.84
William	6.6	\times 5.4	= 35.64

Continue this procedure for the other seven boys and then add together the cross-products for the entire group. Your answer should be 979.60. Hold this figure and go on to Step 2.

(2) Multiply the standard deviation of the spelling distribution by that of the vocabulary distribution:

$$6.6 \times 17.1 = 112.86$$

(3) Then multiply this product by the number of boys taking the two tests:

$$10 \times 112.86 = 1128.6$$

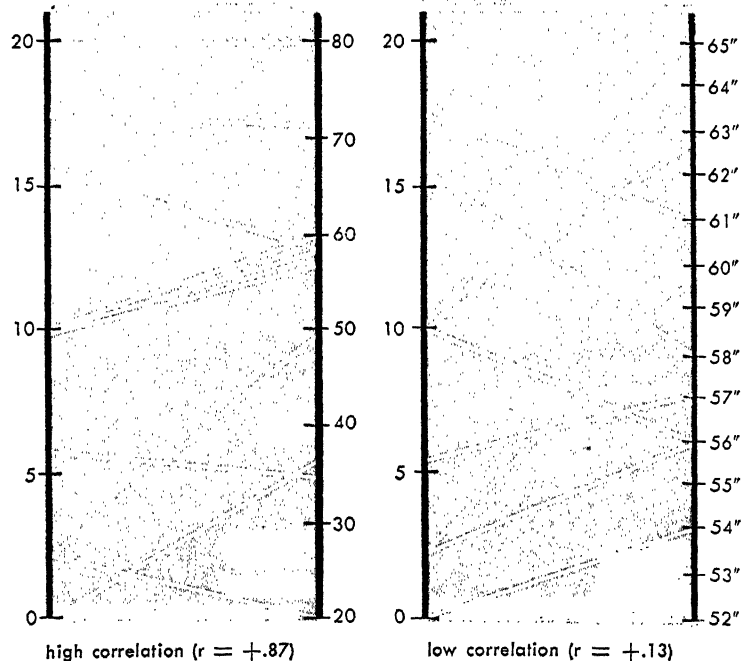
(4) Now divide this figure into the sum of the cross-products, as obtained above in Step 1:

$$979.6 \div 1128.6 = +.87$$

Your answer (+.87) is the coefficient of correlation (usually expressed as r) for the spelling and vocabulary scores.

The correlation between the spelling and vocabulary scores of these ten boys is pictorialized in the first graph at the right. Lines have been plotted to connect the scores made by each boy on the two tests. Although there is some crossing of lines, the pattern indicates a high positive correlation.

The second graph shows the correlation—or, in this case, lack of correlation—between the spelling scores of the same boys and their height in inches. No pattern emerges in this graph, because spelling ability does not correlate significantly with height.



their class should, by the laws of chance, make vocabulary grades above the midpoint of the class. Statisticians have determined what percentage of those who fall in the upper half of the distribution in one trait will fall in the upper half of the distribution of another when there is a given correlation between two normally distributed traits (Chesire, Saffir, and Thurstone, 1933). A table showing representative correlation coefficients and their corresponding percentages follows.

Correlation Coefficient	Per Cent of Better Half on Test A Who Will Fall in Better Half on Test B
.00	50
.10	53
.20	57
.30	60
.40	63
.50	67
.60	70
.70	74
.80	79
.90	85
.95	91
1.00	100

As you can see, the accuracy of prediction varies with the degree of correlation between the two variables being considered.

The coefficient of determination. Frequently the psychologist wants to know the extent to which variance (page 88) in one trait can be explained by variance in another correlated trait. The *coefficient of determination* makes this possible. This is equal to the square of the correlation coefficient and is written as r^2 . For example, if Trait A and Trait B correlate .50, we square .50 and get .25 as the coefficient of determination. This means that 25 per cent of the variance in one trait is explained by variance in the other trait. That is, one fourth of the variance of each trait is due to a common cause or set of causes.

The advantage of r^2 is that it can be added and subtracted meaningfully, whereas the correlation coefficient cannot. In the next chapter we will have occasion to see how useful the coefficient of determination is for expressing the relative contributions of heredity and environment to individual differences in intelligence.

Correlation and causation. If we find a high coefficient of correlation between two traits, we are not justified in jumping to the conclusion that one causes the other. Even when the coefficients are unity (± 1.00), they tell us only that the two traits vary together, not why this is so. We must determine the direction of cause and effect by some other means. A high correlation coefficient suggests the possible existence of a causal relation and thus may stimulate further research on the traits involved. Such research may indicate one of the following possibilities to be true.

Variation in one trait may be caused by variation in another. When we find a correlation between height and ability in basketball players, we may feel reasonably sure that greater height is the cause and better ability is the effect—though, of course, height is only one of many causes operating to produce good basketball players.

Co-variation of two variables may be due to a common cause. If we should find a high correlation between two different abilities like spelling and arithmetic, we would not conclude that you have to be a good speller in order to add numbers well or that you must be able to count the letters in a word before you can spell it. A more logical conclusion would be that a high level of general intelligence is responsible for success in both skills.

The cause and effect relation may be one of interacting. If we should find that income and health are correlated, we might conclude either that healthy people can earn more money than sickly people or that wealthy people can afford better medical care and thus maintain their health. Or both of these conditions could exist at the same time.

MEASURES OF CONFIDENCE

In making psychological experiments or surveys even the most conscientious investigator is forced to limit his study to only a small sample of the total group with which he is concerned. It is impossible for him to test all the college students in the world for reasoning ability—or even, in many cases, all the students in one university. If he wishes to study reasoning ability in college students, he must study a limited number of subjects and draw conclusions about the whole group from the results obtained with this sample. This means there is always a possibility that

his results are due to chance and would have been different had he used another sample.

With how much confidence, then, can our investigator conclude that the results obtained from studying his sample are the same as those he would get if he could study *all* college students? Statisticians have developed mathematical statements in terms of the probability that a particular result would be obtained by chance. If the investigator's result is significant at the one per cent level of confidence, it means that he would get this particular result only once in a hundred times if the population being studied (in this case, all college students) did not actually possess the characteristics revealed by the sample. A result significant at the five per cent level of confidence could be caused by chance factors alone five times in a hundred.

There is no statistical device for telling us whether the case at hand is truly representative. We must always be content with a statement of probability.

S U M M A R Y

In order to study human behavior scientifically, psychologists have developed various instruments for measuring personality. *Personality* refers to the whole person and includes the individual's *social stimulus value*, the conscious and unconscious aspects of his *intrapersonal structure*, and his particular pattern of measurable *traits*.

The instruments used in measurement must be checked for their *validity*, *reliability*, and *objectivity*. That is, they must measure what they purport to measure, give consistent results if repeated, and give the same result when scored by different persons. To be most useful a measurement instrument should be *standardized* on a large group of subjects representative of those for whom it is intended.

The characteristics of validity, reliability, and objectivity are most readily achieved in *psychological tests* such as those designed to measure intelligence. The *Stanford-Binet*, the oldest intelligence test and the one most widely used for children, is primarily a measure of *verbal intelligence*. Nonverbal ability is usually measured by *performance* tests, such as the Arthur Point Scale. Both verbal and performance tests are combined in the

Wechsler-Bellevue, the most widely used test of adult intelligence. In recent years general intelligence (usually expressed as an *I.Q.*) has been shown to be composed of a number of *primary mental abilities*. These are studied by *factor analysis*.

Other measuring instruments used by psychologists in their study of personality traits include: the *rating scale*, which may be relative or absolute; the *interview*, which may be standardized or informal; the *self-inventory*, in which the subject gives the desired information about himself; *behavior sampling*, in which the subject's behavior is observed without his knowing it; and various *projective techniques*. Probably the best known of the projective tests are the *Rorschach* inkblots, the *Thematic Apperception Test*, and the *Make a Picture Story Test*. Projective techniques can be very valuable in revealing unconscious motives, but they must be interpreted with skill and caution. Often their results are of doubtful validity.

When measurements have been made of a number of traits in an individual, the results can be combined in a *psychograph*, or profile, showing the pattern of his traits.

In the important but difficult area of measurement, the science of *statistics* often enables the psychologist to simplify complex data and to make comparisons between different individuals and groups. Since traits are not all-or-nothing characteristics, there is no such thing as "zero degree" of a trait. One important task of statistics, therefore, is to determine a *point of origin* which can be used to make raw test scores meaningful. To find a point of origin, psychologists use various *measures of central tendency* (the arithmetic mean, or average; the *median*, or midpoint; and the *mode*, or score most often earned) and *measures of deviation* (the *centile score* and the *standard score*). By translating raw scores into *standard scores* the psychologist can see clearly where one individual stands in relation to others. Standard scores are based on the *standard deviation* (or *sigma*), derived from the *normal distribution curve*.

Other important statistical measures are the *coefficient of correlation* and the *coefficient of determination*, which are used to measure the degree to which different traits go together, or co-vary. *Measures of confidence* are used to determine the probability that a particular result could be obtained by chance.

CHAPTER FOUR

INTELLIGENCE AND OTHER HUMAN ABILITIES



THE MEANING OF TESTED INTELLIGENCE

FACTORS INFLUENCING INTELLIGENCE

OTHER ABILITIES

GROWTH AND DECLINE OF HUMAN
ABILITIES

Many of the most pressing problems of present-day society involve the growth and decline of human abilities. How can children be educated so that each child's unique pattern of capacities will be fully developed? How can mature persons be aided in choosing vocations that will give full scope to their abilities? How can the ever increasing group of elderly people be given a useful place in society as their capabilities decline? These and many similar questions can be answered only after the organization, growth, and decline of human abilities have been carefully studied.

Before going into a detailed discussion of human abilities and capacities, it is well to pause to be sure we are clear on our terms. *Ability* is always measured as *quality or quantity of actual performance*. When we speak of a person's ability as "high" or "low," we tacitly state that his performance has at some time been observed and rated by some competent person. *Capacity*, on the other hand, means *potential ability*, or "trainability." A person with high capacity is potentially capable of achieving a high degree of ability. When we hear an accomplished pianist, we enjoy his playing and say that he has great ability. But probably no one but his mother enjoyed hearing him "play" the piano at the age of two. At that time he had the capacity to become a great musician, but this capacity had to mature and be developed into ability by training. Both "capacity" and "ability" are logical constructs of the type discussed in Chapter 1. Although they are not "facts," many experiments have indicated that they are valid concepts.

THE MEANING OF TESTED INTELLIGENCE

Despite the current interest in primary abilities and the realization that an individual may be superior in one ability and below average in another, the concept of general intelligence—expressed as an I.Q.—is still highly useful. Because the concept of general intelligence preceded that of primary abilities and has become so firmly entrenched in the thinking of clinical workers, industrial personnel managers, and teachers, much research in the area of intelligence has been in terms of general intelligence as determined by the older types of test. Thus, in studies of the constancy of intelligence and the factors influencing it, the terms "intelligence" and "I.Q." have been used almost synonymously.

THE CONCEPT OF I.Q.

In developing the first intelligence tests, Binet made no attempt to predict a child's mental status at a future date but rather was

content to describe the child's status at the time of testing. But as more and more children were tested and retested at later dates, it was found that a retarded child usually fell further and further behind as he grew older. If a four-year-old child had a mental age of three, for example, his mental age at eight probably would be only six. Thus, although the mental and chronological ages maintained the same relationship to each other ($\frac{3}{4} = \frac{6}{8}$), the total retardation would have increased from one year to two years.

Early in the history of intelligence tests, therefore, psychologists adopted the practice of stating the relationship between mental age (M.A.) and chronological age (C.A.) as a ratio—that is, dividing M.A. by C.A. (Stern, 1914). This ratio gives a figure for any given individual that remains *more or less* constant over a period of years. Thus it is possible to compare individuals of differing ages or the same individual at different ages. This con-

cept, which we call the *Intelligence Quotient* (I.Q.), was adopted by Terman for use in the 1916 Stanford revision of the Binet tests. As we saw in the last chapter, the formula for the I.Q. is easily written as $\frac{M.A.}{C.A.} \times 100$.

The relation of M.A. to C.A. has been found to maintain a steady ratio up to the age of about thirteen. After thirteen, however, mental age increases more slowly. It levels off at about sixteen and thereafter remains fairly constant. Because C.A. keeps increasing while M.A. remains constant, the figure for I.Q.—if calculated in the usual way—declines. Therefore, the divisor (C.A.) must be “corrected” in order to obtain an I.Q. comparable to those obtained at earlier ages. Since this “correction” is too complex to calculate every time the test is given, Terman and Merrill in their 1937 edition of the Stanford-Binet tests provided a table for finding I.Q.’s quickly.

It is apparent by now that the I.Q. is a convenient way of showing the rate of mental growth. If you know an individual’s present chronological age and mental age, you can compute the rate at which he is growing mentally and predict with a striking degree of accuracy what his status (mental age) will be when he reaches any specified chronological age.

CONSTANCY OF THE I.Q.

The whole concept of the I.Q. presupposes that an individual’s rate of mental growth will remain constant, so that his mental age will continue to bear the same relation to his chronological age. A great many studies have been carried out to determine whether or not this actually is the case. The universal conclusion is that the I.Q. *does* remain essentially constant when conditions remain the same—that is, when health, type of education, and home situation do not change markedly. The single notable exception is in the case of very young children, with whom there are special testing difficulties.

We shall examine here some typical studies that have been made on individuals ranging from the feeble-minded to the very superior.

One study was made of 1106 children who were referred to a Child Study Department because of unsatisfactory school adjustment—behavior problems as well as poor achievement. The children

were tested at the beginning of the study and then retested one or more times. They varied in age from about six and a half to twelve and a half years at the time of the first testing. The average amount of I.Q. change found in retesting was 5.08 I.Q. points. Despite the fact that approximately half of the children were placed in special classes where their difficulties would receive special attention from well-trained teachers, there was a tendency for the lower I.Q.’s to decline slightly. Nevertheless, this study indicated that the I.Q. remains relatively constant (Hirt, 1945).

A recent study of fifty-one children tested while in the first grade and then retested as college freshmen twelve years later showed comparable results. The greatest change in I.Q. found in this study was 9 I.Q. points; three fourths of the cases changed 5 points or less (Brown, 1950).

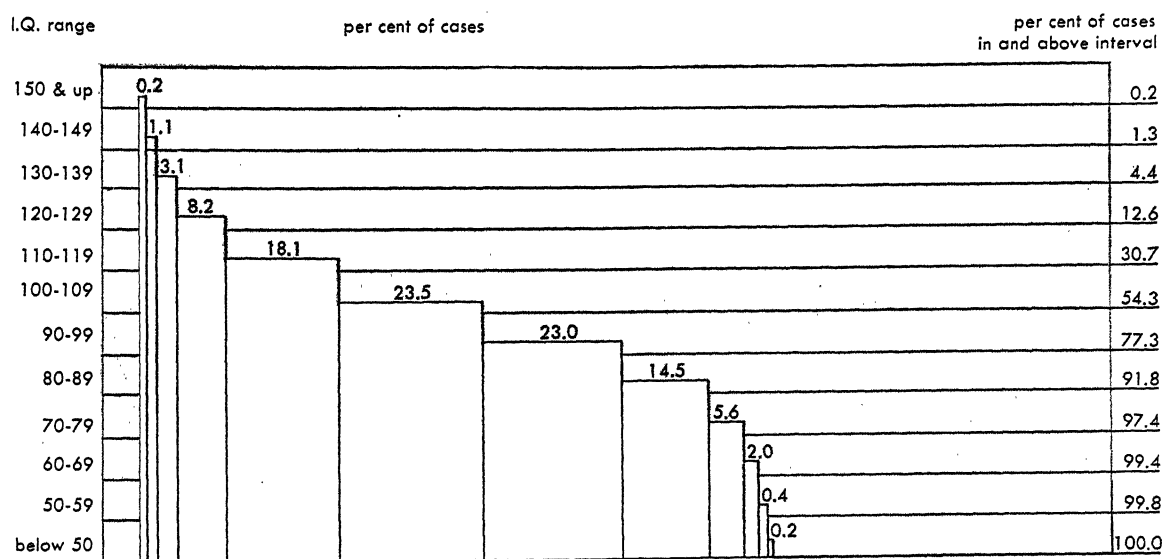
A recent comprehensive and convincing demonstration of the constancy of high I.Q.’s as measured by the Stanford-Binet tests is reported in the long-run study of gifted children conducted by Terman. In 1922, at the time of the first testing, the group was in the upper one half of 1 per cent of the total population. Six years later and again eighteen years later, a majority of the subjects were found to be in or close to the upper 1 per cent of the general population. This finding gives little support to the popular belief that bright youngsters are in danger of “burning out” mentally later in life (Terman, 1940).

Exceptions to the general rule that I.Q.’s remain essentially constant are found in I.Q. determinations made upon very young children. The bulk of the available evidence indicates that children who are under four years when tested the first time will show an average difference of ten I.Q. points on a follow-up test made two or more years later (Goodenough and Maurer, 1942).

In one study children were first tested at two to five and a half years and then retested ten years later. Verbal items were found to be more dependable than performance items in predicting the I.Q.’s that were later achieved in the retesting, which used items of highly verbal nature (Bradway, 1945).

This early shifting is a result of the fact that at the lower years the Stanford-Binet test (or the others now available for small children) measures factors other than verbal intelligence

Distribution of I.Q.'s in Terman-Merrill Standardization Group



—such as rate of physical maturation and amount of muscular dexterity.

Some of the factors that may account for the constancy of the I.Q. after early childhood will be discussed later in this chapter.

DISTRIBUTION OF I.Q.'S

In Chapter 3 we learned that most traits, including intelligence, are distributed among the population according to a “normal probability curve,” with the bulk of the scores falling in about the middle and with roughly the same number of scores above as below. The graph on this page, based on the 2904 cases on which the 1937 Revision of the Stanford-Binet Tests was standardized, shows the percentage of the cases falling in each division (Merrill, 1938). As we can see, about half of the population falls in the category of “normal” —90-109. Above and below this range, the frequency of cases drops sharply. Only about 13 per cent of the population have I.Q.'s above 120; only 4.4 per cent above 130.

Studies have shown that the average I.Q. of different occupational groups is higher as the economic standing of the different occupational groups improves—although within every group, particularly those in the middle range, there is considerable variation in I.Q. The range of I.Q.'s in professions like accounting or the law is smaller, because only persons of

high I.Q. can enter such occupations. But in occupations like auto repairing or clerking, persons of low, average, and high I.Q. may be found. The table on page 96 gives the typical I.Q. range in several occupations (Harrell and Harrell, 1945). You will remember that $\pm 1\sigma$ (plus or minus 1 standard deviation) contains 68 per cent of the cases in a normal distribution such as this.

MEANING OF I.Q.'S
IN TERMS OF BEHAVIOR

What is a person like who has an I.Q. of 100? What can he do that someone with an I.Q. of 70 cannot? Trained psychologists, as well as teachers and physicians dealing with problem cases, associate different I.Q. values with definite pictures of adaptive behavior.

Mental defectives. The feeble-minded, about 2½ per cent of the population, are classed roughly into three grades:

1. *Idiots* (I.Q.'s up to 25) are the most seriously deficient of the feeble-minded. They never learn to avoid the common dangers of life and would soon die if not cared for by others. Many of them never learn to dress themselves or to say even a few simple words. Some never learn to sit up, remaining in bed all their lives. On the average they learn no more than a two-year-old baby.

2. *Imbeciles* (I.Q.'s from 26 to 50) learn to

talk a little and, under close supervision, to do simple work such as digging ditches, rough painting, and mopping floors. They cannot, as a rule, understand the value of money and should not be permitted to live outside an institution or away from the close supervision of their families. Imbeciles attain a mental ability ranging from that of an average three-year-old to that of an average seven-year-old child.

3. *Morons*, or high-grade mental defectives (I.Q.'s from 51 to 70), can learn to read and write and can perform certain types of routine factory work. As adults they have the intellectual capacity of average seven to twelve-year-olds; they cannot be expected to go beyond the fifth or sixth grade in school. If left to themselves morons often run afoul of the law, for many are incapable of recognizing their moral and legal obligations or of foreseeing the consequences of their behavior. The fact that they mature physically in a normal manner but lack the capacity of more intelligent persons to regulate their emotional behavior makes their problem as adults an especially difficult one. The frequency of illegitimate motherhood, for example, is highest among moron girls. Many high-grade mental defectives become juvenile delinquents, prostitutes, professional toughs, and petty thieves—though, of course, low intelligence is only one of many possible factors in

delinquency. It is important to remember, furthermore, that the behavior of persons of low intelligence does not follow a set, stereotyped pattern but depends largely upon the complexity and demands of their environment and the kind of training they receive.

In the final analysis the definition of feeble-mindedness is a social one. People who because of low intelligence are not capable of conducting their affairs without supervision are called feeble-minded. Around I.Q. 70 there is a band of doubt where some individuals are feeble-minded and others are not. Again, the exact intellectual level below which an individual cannot shift for himself is significantly influenced by the training he is given and by the kinds of adjustment his environment requires.

Many individuals who make low scores on intelligence tests in childhood are later able to become useful citizens.

This fact was brought out in a recent follow-up study of 127 persons, aged thirty-six to forty-nine years, who had obtained a mean I.Q. of approximately 60 when they took the Binet test in childhood. These were the only survivors who could be located from a group of 206 feeble-minded tested in 1916. More than an average number of the group had died or moved away from their native state, Nebraska. A small percentage were institutionalized.

Those subjects living in their own homes showed wide variations in economic level, but most of them were regularly employed, all but seven holding at least part-time jobs. A lower percentage of them were married than is normal for their age group, and they had somewhat fewer children than average; however, the great majority of their children had average intelligence and were going through school without being retarded, one girl even succeeding in college. A large percentage of the males had been in difficulty with the law.

Test results showed that about 65 per cent of those who had tested low originally were now in the dull-normal or average range; about 10 per cent had risen from the deficient level to the low borderline classification but were still self-sufficient members of society (Charles, 1953).

These increases are not proof of any improvement in native intelligence, for too many different variables might have entered into the two different tests. However, it is encouraging to see that such a high percentage of children who obtained low intelligence test

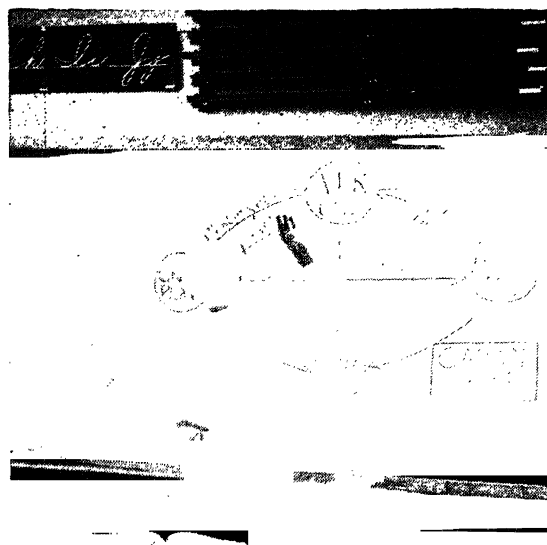
occupation	mean Army G.C.T. score		mean equivalent I.Q.	
	S.D.		S.D.	
accountants	128	12	125	11
lawyers	128	11	125	10
engineers	127	12	124	11
teachers	123	13	121	12
stenographers	121	13	119	12
bookkeepers	120	13	118	12
clerk-typists	117	12	115	11
radio repairmen	115	15	113	13
receiving & shipping clerks	111	16	111	14
sales clerks	109	16	108	14
auto mechanics	101	17	101	15
painters (general)	98	19	98	16
barbers	95	21	95	18
farm hands	91	21	91	18
teamsters	88	20	89	17

scores were able to become self-supporting citizens. A sample case study taken from this investigation shows the kinds of achievement that some of these individuals were able to make.

One subject, aged forty, obtained an I.Q. of 50 on the 1916 test and 84 on the Wechsler-Bellevue retest. "H.G. is neat and clean in appearance and pleasant in manner. He is not married and lived with his mother until her death several years ago. Since then he has stayed on in the family home, recently with a married sister and her four-year-old boy. At the time of interview the home was neat, clean, and pleasant. . . . The subject has been employed as a custodian in an industrial plant for the last three years. Before that, he sold newspapers and candy in a railroad station. He had small, occasional relief grants, the last being in 1941 and in 1947. He was brought before the juvenile court for a misdemeanor in 1928, but there is no evidence of law-breaking since then. . . . The subject's conduct and performance would suggest that the Wechsler score of 84 I.Q. is a better index to his ability than the 1916 Binet 50 I.Q." (Charles, 1953).

Recently the American Psychiatric Association has adopted a new method of classifying mental defectives. According to this system the degree of defect is always estimated in terms of the individual's physical, emotional, social, and vocational effectiveness as well as his I.Q. Idiots and imbeciles are grouped together as *severely* deficient because both require custodial care. The term *moderately* deficient is applied to mental defectives with I.Q.'s ranging between 50 and 70 who require special training and guidance. Those whose functional impairment is less serious, with I.Q.'s ranging usually between 70 and 85, are classified as *mildly* deficient. Because these classifications are based on the individual's effectiveness as a functioning member of society, they are highly useful in clinical situations and probably will gradually replace the older terms of idiot, imbecile, and moron.

The mentally gifted. On the whole the mentally gifted have not received the attention and stimulation they deserve in our mass education system. As Dr. Sidney L. Pressey has pointed out, children that have precocious ability in music or athletic skills are usually encouraged and given every opportunity to practice and improve; whereas intellectual precocity is too often regarded as "somehow



Establishing schools exclusively for the mentally gifted is one way of providing the exceptionally bright child with the opportunity to develop at his own rate of speed. The seven-year-old boy above, who attends such a school, is confidently diagramming the carbon cycle, a task usually accomplished with difficulty by high school students.

not quite healthy," and the gifted child, if not actually ridiculed, is not permitted to progress as fast as he could (Pressey, 1955). Fortunately the current trend is in favor of broader opportunities for the gifted through various acceleration programs. The old grade-skipping method, unsatisfactory at best, is being replaced by such systems as the "primary pool," out of which children move whenever they finish primary work. Rapid-progress sections in junior and senior high school (enabling especially bright students to do three years' work in two) and credit by examination in college are other experiments that permit mentally gifted youngsters to move at their own pace without being unduly conspicuous.

A recent study of gifted children has shown that they may make remarkable achievements at an early age.

Three gifted boys and an average boy of the same age were compared over a period of seven years. All of them attended a private school which provided unusual opportunities for self-expression. All had similar social and economic backgrounds, with both fathers and mothers being professional people.

Pupil A, the most gifted, had an I.Q. of 170 when first tested on the Stanford-Binet; on subsequent tests it rose as high as 200 but later fell to about 180. Pupil B began with an I.Q. of about 135 and rose to about 150. Pupil C began at 125 and rose to 135. Pupil D, the average boy, stayed slightly above 100 except for one test on which he rose to about 115, later falling back again to about 105. (This tendency for I.Q.'s to rise faster with increasing age in gifted children than average ones has been noted in other studies.) On all tests the boys remained in the same rank order of intelligence. All four boys were above the national averages in height and weight and, contrary to common opinion, the gifted ones were superior in manual dexterity and social maturity ratings as well as intellectual ability.

At the age of eight the boys were given a number of science questions. When shown a magnet the three gifted ones used it spontaneously, the average one only when told to. He commented, "It's a magnet. Some kind of electricity sucks it up." The most gifted child when asked why the magnet picked up bits of metal replied, "Because of magnetic suction—no, magnetic reaction or whatever you call it. You see it won't pick up anything rusty." (A rusty nail, also the subject of questions, was lying close by.) At the age of seven Pupil A had written a number of literary productions. A Christmas poem with an illustration, three stanzas of a poem called "The Carousel," and an arithmetic reasoning problem had appeared in the school newspaper. He had also produced three book reviews, a play written in collaboration with others, a letter to a sick teacher, a limerick, an original story, a report of a trip to the museum, a Halloween story, and a science notebook of eight sections with illustrations. Two previous science notebooks, with headings and pictures, had been produced at the ages of five and six. The other two gifted children had produced one book review apiece up to the age of seven, whereas the average child had written only a composition consisting of three sentences.

On the whole the gifted boys were popular and showed leadership ability, though Pupil A was so exceptionally superior that he had some difficulty in social adjustment. Thus, this study shows that gifted children are often superior in nearly every respect rather than being peculiar, isolated individuals with ability in the intellectual sphere alone (Hildreth, 1954).

What becomes of such gifted children in later life? Fortunately a follow-up study of a large number of highly intelligent children is available to carry us through the second act of

the drama of superior intelligence. For over thirty years L. M. Terman followed the fortunes of 1300 individuals representing the cream of the crop of some 250,000 California school children tested in 1922 (Terman, 1940, 1954). Each of these subjects had an I.Q. of 140 or more; the average I.Q. for the group was 150. In 1940 and again in 1952 surveys were conducted to see how well these individuals had succeeded in life. The results leave little doubt that the intelligence test measures something vitally important to successful living. Here are the facts:

1. The death rate was much lower than that of the control group used for comparison. This explodes the old notion that bright children are sickly and that a strong back goes with a weak mind.
2. The insanity and suicide rates were lower than those of the general population. This fails to support the legend that "genius is akin to insanity."
3. The divorce rate of the gifted group was lower than that for the state of California as a whole.
4. Ninety per cent of the gifted group entered college; of these, about 93 per cent graduated. This showing is about forty times higher than the standard for the country as a whole. They received higher college grades and more honors than did the average college student. The gifted were also far more active in student-body affairs, as shown by election to office and activity point scores.
5. The earnings of the gifted group far excelled those of the general public of the same age. Not one of the group was on the relief rolls during the depression, even though many finished their schooling and were just starting in life when it hit. At age thirty their average earned income was twice the national average at that time. A dozen of the men earned more than \$10,000 per year. Only one tenth of 1 per cent of the general population achieved such high earnings at that time.
6. Measured in terms of creativity, as well as earnings, the achievement of these gifted individuals was striking. (The following figures include only the men, since most of the women married and did not follow professional careers.) By 1950, when the 800 men included in the study had reached an average age of forty years, they had published 67 books, more than 1400 technical or professional articles, over 200 short stories and plays, and 236 miscellaneous articles, not counting innumerable publications by those who were journalists or radio and TV script writers. Of the 800 men 78 had taken Ph.D. or equivalent degrees, 48 had medical degrees, 85 had law degrees, 74 had taught at the college level, and 104

were engineers. Nearly all these figures are from ten to thirty times as large as would be found for 800 men of the same age chosen at random.

7. A special Concept Mastery Test, designed to "reach into the stratosphere of adult intelligence," was administered to 950 of the group in 1939-1940 and more than 1000 in 1951-1952. On both tests they scored as far above the average adult as they had scored above the average child when originally tested. Also, in the twelve-year interval between the two adult tests, 90 per cent of those who took both tests had increased their intellectual stature, as shown by higher scores on the second test. This disproves the "early ripe, early rot" idea that people who are brilliant in their youth deteriorate early.

Terman also studied the offspring of his gifted group and found that the average I.Q. of the 300 offspring tested was 127. Since this is considerably lower than the average I.Q. of 150 which the gifted group had, it needs some word of explanation. Several factors must be remembered.

First, the gifted parents had married husbands or wives who were, on the average, of somewhat lower I.Q. than themselves. Thus each child was the product of heredity from two parents, only one of whom, usually, was of exceptionally high I.Q. Second, heredity operates to produce not merely similarities but also differences between parents and their children; each child gets only half of the chromosomes which each parent has. Finally, as a result of the presence of recessive genes that sometimes can express themselves through new pairings, a child often possesses quite different hereditary traits from those manifested by either parent.

FACTORS INFLUENCING INTELLIGENCE

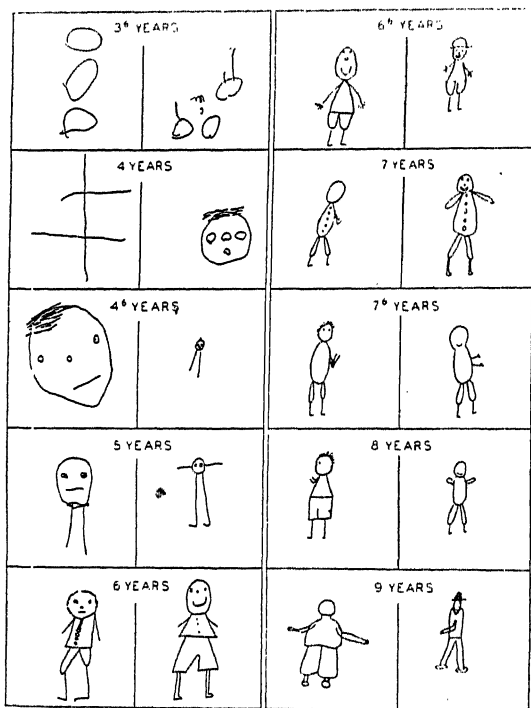
There are two possible hypotheses that may account for the high degree of constancy in the I.Q. *First hypothesis:* that I.Q. depends upon the quality of the individual's environment and will remain constant as long as his environment remains the same. *Second hypothesis:* that I.Q. depends upon the heredity of the individual and is constant because the heredity of the individual does not change.

The problem of determining the influence of heredity and environment upon the development of intelligence is necessarily complex, but the answer is of such importance to educators and to society in general that psychologists have devoted a great deal of attention to the question. In this section we shall not only examine the findings about the relative influence of heredity and environment upon intelligence, but shall also consider the influence of cultural differences and of such special factors as order of birth, health, and differences in sex.

HEREDITY AND ENVIRONMENT

One way to determine the roles of each of the two main factors in intelligence is to hold one of them constant while the other varies. We can do this in several ways: (1) We can keep heredity the same and vary environment by (a) comparing identical twins in different environments and (b) comparing the same individual in different environments. Or (2) we can keep the environment the same and vary heredity by comparing the relationship between foster-child I.Q. and home factors with the relationship between real-child I.Q. and the same home factors. If environment is a potent factor in determining individual differences, children who are unlike in heredity should come to resemble each other in intelligence through the action of the common environment. This research design calls for the use of correlation coefficients (see page 88).

Heredity the same, environment different. The best way to hold hereditary factors constant while varying environment would be to study a large number of identical twins, the members of each pair being separated at birth and sent into foster homes which were chosen by chance and which ranged in quality from poor to excellent. After an interval of years had elapsed, these twins would be subjected to many kinds of psychological tests and measurements. The scores of each twin would then be compared with the scores of the other twin. Since we know that the heredity of identical twins is identical, we could assume that any differences between the twins in a pair—anything less than perfect correlation of their test scores, given perfectly reliable tests—would have to be attributed to environmental influences.



Twins "T" and "C" made the drawings above as responses to the "Draw a Man" test, used in a study of the twins from infancy through adolescence. Note the similarities—and differences—between the two drawings at each age, as well as the gradually increasing accuracy and completeness of the drawings of both twins over the six-year period shown here. When their drawings from four and a half through twelve years were rated on the Goodenough scale, it was found that Twin "C" was slightly superior but that the total scores of the two were strikingly similar—199 points for Twin "C" as compared with 180 for Twin "T" (Gesell and Thompson, 1941).

✓ A study of this kind has been made of nineteen pairs of identical twins who happened to be reared apart through adoption into different foster homes. The average of the differences between the members of each of the nineteen twin pairs was found to be 8.2 I.Q. points. This difference is only slightly larger than the average of the differences between the scores on two tests taken by the same individual at an interval of several years. That is, the intelligence test scores of identical twins reared apart (sometimes in similar and sometimes in quite different environments) were almost as similar as two scores achieved by the same person at different times. Furthermore, they were nearly as similar as those of identical twins reared together. The investigators concluded that the possession of identical heredity was a factor

operating systematically to determine the development of similar intelligence (Newman, Freeman, and Holzinger, 1937).

Unfortunately no measures of environment were included in the study. It is quite possible that environments were not completely randomly assigned. If this should be true, the conclusion would be weakened.

Another fruitful way of studying twins, which does not require separating them, is to compare the performance of identical twins, who have the same heredity, with that of like-sexed fraternal twins, whose heredity is no more similar than that of ordinary brothers and sisters. Twins of the same sex who are reared together will have a very similar environment. If environment were the determining factor in intelligence, therefore, any twin—whether identical or fraternal—would make about the same score on an intelligence test as his own twin of the same sex. On the other hand, if heredity were primary, identical twins would make very similar scores, whereas the scores of fraternal twins would differ to a greater extent.

A study of this type conducted in England supports the hypothesis that there is a general intelligence factor largely determined by heredity. It also indicates, however, that the various primary mental abilities vary in the degree to which they are inherited.

Fifty-six pairs of like-sexed twins, some fraternal and some identical, in the age range of eleven to fifteen years, were given Thurstone's Chicago Tests for the Primary Mental Abilities together with another test designed primarily to measure speed and intellectual level. The correlations of the scores of the identical twins were much higher than those of the fraternal twins on the test as a whole and on each of the primary abilities except number, on which the identical twins made only slightly more similar scores than the fraternal. The highest correlations were obtained on verbal and fluency factors, indicating that these may be highly hereditary. Numerical ability appeared to depend more upon training. This was also true of space visualization, which had a somewhat lower intra-identical correlation than verbal, fluency, or reasoning factors. Surprisingly, the speed factor showed even less correlation for the identical twins than the fraternal twins; this would seem to indicate that intellectual speed probably does not depend upon inherited structures (Blewett, 1954).

The other way to separate the effects of environment and heredity is to observe what happens to the I.Q. of the same individual when he is placed in a different environment. Studies of this type have analyzed the I.Q. changes in children placed in foster homes and in children attending nursery schools. These studies are important because they indicate the extent to which changes in economic status and education can affect the development of intelligence.

One foster-home study observed the changes in I.Q. in a group of seventy-four children after they were removed from an orphanage to superior and to inferior foster homes. Their average residence in foster homes was four years. The results show that the children removed to superior homes gained an average of 5.3 points in I.Q. scores, while those removed to inferior homes gained only 0.1 point. The increase may have been greater than the test results indicate because the original (1916) Stanford-Binet Scale was a little too difficult at the upper ages included in this study. (It had been standardized on children in school, who are somewhat superior to the general population of all children of the same age because some of the slower pupils drop out of school.) Allowing for this we are probably safe in concluding that the effect of the better environments was an increase in I.Q. of about 9 or 10 points, not just 5 (Freeman *et al.*, 1928).

Another frequently quoted study of environment's influence on I.Q. is interpreted as being in line with the study just reviewed. Children whose mothers' family backgrounds were inferior in intellectual level, occupational level, educational achievement, and socio-economic status were placed in foster homes superior in all these respects (Skodak, 1939). At the end of one year of residence in the foster homes, the I.Q.'s of the adopted children had increased an average of 5.7 points; by the end of two years, the average increase was 9.8 points. No further increases occurred, indicating that the developmental deficit caused by poor environment apparently had been met by this time (Skodak and Skeels, 1945).

From these studies we can say that removing apparently dull children to good foster homes does seem to make some improvement in their I.Q.'s but that the amount of improvement is limited by their inherited capacity. Several investigations of the effect of nursery-school training on I.Q. lead in general to similar conclusions.

One study of a group of six hundred children from decidedly superior homes showed that stimulating environment of the pre-school was responsible for an average increase of about 15 I.Q. points (Wellman, 1932).

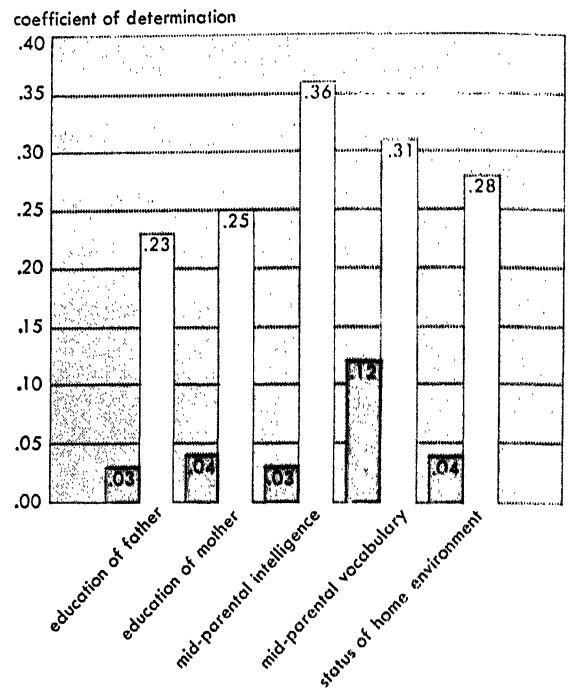
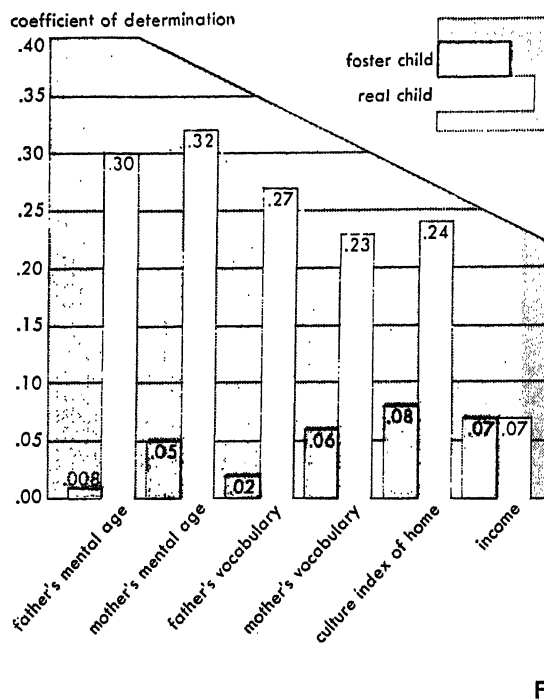
A similar experiment—in which twenty-eight children were measured before and after one year's experience in another pre-school of high quality—showed average changes ranging from 2 to 7 points for various age groups (Goodenough, 1928).

A three-year study was undertaken to determine, under controlled conditions, the effects of pre-school education on the I.Q.'s of underprivileged children of average and below average intelligence. The children were in residence at a soldiers' orphans' home, a state institution designed for the care of dependent and neglected children. Children of pre-school ages were divided into two groups: one pre-school and one control group, matched on chronological age, mental age, I.Q., sex, nutritional status, and length of residence in the orphanage. The two groups experienced the same life and routine, except that the pre-school group spent several hours a day at the pre-school building, where a variety of stimulating activities took place. Over the longest period (approximately twenty months) the pre-school children gained 4.6 points in I.Q., while the control group lost 4.6 points. Thus by the end of the experiment there was a difference between the I.Q.'s of the experimental and control groups of 9.2 I.Q. points (Skeels *et al.*, 1938).

In looking back over these foster-home and pre-school studies, we see that the differences between good and bad environments in foster home or school produce an average difference of around ten I.Q. points between experimental and control groups. However, there is a wide variation in the differences actually found in the various studies, one showing differences as small as two points and another showing differences as large as fifteen points. This raises the question of whether the same differences can be expected regardless of the age at which the environmental changes are made.

To throw light on this question, an analysis has been made of the case histories of one hundred children who were each given the advantages of a good foster home for four years. The age range at time of entrance into the foster home was from three to fourteen years, and the I.Q. range was from 70 to 130.

Child's I.Q. Correlated with Other Factors



Analysis shows that any advantageous effects on I.Q.'s obtained by transferring children from an inferior to a superior environment occurred when the change was made before the age of six. There was an average increase of 6.6 I.Q. points in a group of thirty children who were six years old or younger when adopted; an average increase of only 0.7 I.Q. points in a group of forty children who were seven, eight, or nine years old when adopted; and an insignificant decrease in a group of children who were ten to fourteen at adoption (Reymert and Hinton, 1940).

All these studies lead us to conclude that the I.Q. can be changed to some extent by environment, especially at an early age, but still retains considerable constancy even when environment is markedly changed.

Heredity varying, environment the same. If children are adopted into foster homes of high or low quality regardless of the quality of their heredity, the coefficient of determination between the quality of the homes and the quality of the children's heredity would be zero. Therefore, if the amount of co-variation of quality of the environment and intelligence of the foster children increased after a period of residence in the foster homes, we would

interpret that increase as reflecting the effects of environment. Does this occur? Because environment cannot be held constant in the way that heredity can, we must rely upon correlation studies to interpret the available evidence.

One study compared the correlations between I.Q. and various other factors for a group of foster children and for a control group made up of children living with their own parents. On the chart (above, left) compare the coefficients of determination between foster parents and children with those of parents and own children. Notice that father's mental age, mother's mental age, father's vocabulary, and mother's vocabulary are all more highly related with I.Q. in the case of real children than in the case of foster children (Burks, 1928).

In another study a group of children living with their own parents were compared with a group of children who had been adopted into foster homes before the age of six months and who were five to fourteen years of age at the time of the study. In this latter group it was assumed there could be no relationship between the quality of the heredity of parents and that of the adopted children. To make the two groups comparable, each child in the adopt-

ed group was paired with a child in the other group on the basis of the real or foster parents' intelligence test scores and on the basis of objectively measurable environmental factors, such as occupation and educational status. The correlation between the intelligence of the biological parents and the intelligence of their children must be accounted for on the basis of the combined effects of parental heredity and environment of the home. In the case of the foster-parent, foster-child combinations, the relationship must be accounted for on the basis of the influences of environment alone. The coefficients of determination obtained are shown in the chart on the opposite page at right.

In this chart "mid-parental intelligence" is the average of the intelligence test scores of the two parents; mid-parental vocabulary is, similarly, the average of the vocabulary scores of the two parents. By comparing the size of the coefficients of determination for the parent-child combinations of the two groups, it is possible to calculate the contribution of measurable environment. Notice that the coefficients of determination between real parents and real children are much higher for all the traits studied than are those between foster parents and foster children. In other words, parental heredity plus environment of the home contributes much more to the determination of the intelligence of the children studied than does environment alone (Leahy, 1935).

There is an important fact to remember in appraising the relative effects of differences in environment and in heredity on differences in intelligence or any other mental trait. This is that heredity does not consist wholly of the traits observable in a child's parents. The parents' genes, which they pass on to the child, include determiners for many more traits than they themselves visibly possess. Thus, if we judge a child's mental heredity solely by his mother's I.Q. and his father's I.Q., we are failing to consider all the genes which have been transmitted to him from many generations of his ancestors but which do not happen to be visible in his parents. While environment acts only during the lifetime of an individual, hereditary influences reach back of the parents into the far-distant past. These preparental influences are bound to be a tremendous force in determining intelligence.

The comparisons outlined above strongly indicate that common heredity, even without common environment, works rather strongly to produce similar I.Q.'s. Common heredity

plus common environment works even more strongly. Of the two, common heredity apparently makes by far the more important contribution.

CULTURAL FACTORS

As we have seen, intelligence is not just one general ability but a complex of abilities. It is interesting to study the rate at which these different abilities develop in persons in different cultures.

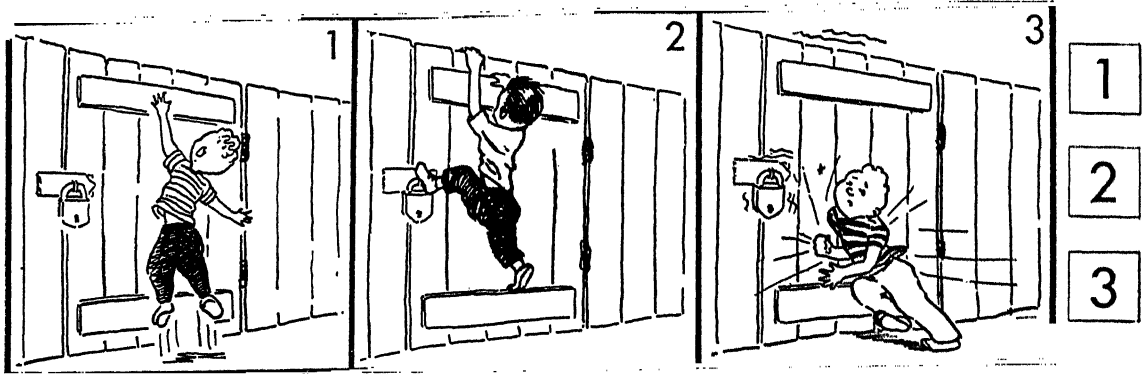
Different environments apparently foster different abilities. Unfortunately there is too little evidence on this important subject, but indications are that a particular environment—because it calls for particular adaptive behavior—will bring about accentuated development of the special abilities needed. For example, when students entering college in Ceylon were given intelligence tests, striking differences were found between their performance and that of American college entrants.

When a group of 212 students entering the University of Ceylon in 1950 were tested, the men made a median centile score of 57.0 and the women a median centile score of 44.4. In the United States the median centile score for men and women is 50.

A really striking result appeared on the language factors. The Ceylonese men made a median centile score of 76.8 and the women a median centile score of 71.5, as compared to the American 50—and the test was given in English, which is not their native tongue! On the nonlanguage factors, however, the medians were only 12.0 for men and 5.6 for women (Straus, 1951).

The culture of Ceylon may well explain these differences. As is true of the Far East as a whole, Ceylon emphasizes verbal achievement. Early education consists of verbal, rote learning. The poet and the philosopher, not the scientist and the engineer, are the most revered citizens. Thus the young students develop remarkable verbal ability but are deficient, by Western standards, in certain nonverbal skills.

Within the United States, too, different environments foster the development of different skills. A very interesting study has been made comparing first-grade students in two New York schools in their performance on the Stanford-Binet examination.



Shown here are selected practice problems from the Davis-Eells Games. For each set of pictures in the Primary Test (above), the subject marks one of the numbered boxes to indicate which child is using the best method to accomplish what he is trying to do. In the Elementary Test (left), the examiner reads three statements about each picture and the subject indicates which one he thinks is correct. The choices for this example are:

No. 1 Box: *The boy did not wear his shoes.*

No. 2 Box: *The boy broke the window.*

No. 3 Box: *Nobody can tell from this picture what the boy did.*

Here, as in many cases, "Nobody can tell" is correct. Does it appear that the Davis-Eells Games have achieved their objective of being "culture-fair"?

The two schools differed widely in that the children attending them were drawn from the opposite ends of the social and economic scale. Group A was made up of 140 children from a school situated in a crowded slum area where the children had suffered all the evils of the depression almost from the time of their birth. Foreign languages were spoken in the majority of these homes. Group B was made up of 114 first-grade children from a school located in a superior residential section in upper Manhattan. In addition to the Stanford-Binet examination, a Goodenough drawing test (a nonverbal intelligence test) was administered to each child individually in the two groups.

The average Stanford-Binet scores of Group A were about 13 points under those of Group B. On the Goodenough drawing test the difference was only 4.8 points.

In specific abilities, however, it was found that Group A, made up of the underprivileged children, showed relative superiority in counting and handling money and in sensory discrimination. Group B showed relative superiority on tests which involved sentences, digits, rhymes, and stating the essential

similarities and differences between concrete objects (Saltzman, 1940).

A good social and economic background, with its greater opportunities for stimulation and development, gave the children in the privileged group an advantage in using their inherent abilities on verbal intelligence tests. The children from the slums, on the other hand, were more preoccupied with money, which was scarce in their hands; they may have developed their sensory discrimination by avoiding the dangers of their environment, such as dodging automobiles as they played in the street. In short, the children in each group developed the abilities most needed for life in their particular environment.

Can tests discount cultural differences? It is impossible to devise test items that do not utilize *some* past experience. As test makers have tried to compare individuals from different socio-economic groups, they have been faced with the crucial problem of finding test materials with which each group has had

equal experience. For a test situation to be fair, it must be one that is common to the culture and the practice of all the socio-economic groups to be tested.

The currently used tests of intelligence were made up by members of the higher socio-economic groups and there is, therefore, a real danger that they unfairly penalize those who are members of the lower groups. The child of a family who did not value "book learning" and had no books in their home would be at a disadvantage on questions, for example, that involved verbal skill and knowledge of precise meanings of words. Also he would probably be rather uninterested in such questions and might make less effort to answer them correctly than a child whose parents used language well and valued reading. Again, children of different social groups might answer quite differently a question such as "What would you do if you found a purse with \$5.00 in it?" or "Look at this picture and tell me what's funny about it."

Thus on the Wechsler Intelligence Scale for Children, described in Chapter 3, it has been found that children from higher economic levels of society make higher mean scores than children from lower economic levels (Estes, 1953). Although the difference between the two groups is significant for second-graders, at the fifth-grade level the difference is so slight that it is no longer regarded as significant. As children grow older, other cultural influences—such as movies, Sunday Schools, and the public schools themselves—have a greater effect on the children's development and tend to offset some of the effects of poverty and a poor home environment.

Although tests can never be entirely culture free, efforts are being made to design tests which at least will be culture fair. Three major steps have been suggested for constructing tests to determine the relative intellectual capacity of individuals from all socio-economic levels in the United States (Davis and Havighurst, 1948).

1. Test makers must choose problems that are equally common and equally motivating to all socio-economic groups, and they must express these problems in symbols that are culturally common.
2. They must sample a far wider range of mental activities than they now do and thus greatly reduce the importance given to academic types of problems. Many intelligence test items have been selected on

the basis of their correlation with ability to do conventional school work, which is so much a part of the culture of the upper economic groups. Too often they have neglected the useful and practical kind of experience which is so much a part of the culture of the poorer classes.

3. Test makers, to be sure they are really testing intelligence, must discover an objective method of validating test items to replace the circular validation now used—considering an item valid if it correlates highly with ability to do school work.

Until these steps are taken and surveys are made with the resulting tests, we cannot know just how much to discount the findings of studies in which people of different backgrounds have been given the same tests.

Comparing racial or nationality groups. Where individuals being tested are not only of different socio-economic levels but also of different racial, cultural, and even geographic backgrounds, all the problems considered above are further accentuated.

The question of the possible superiority of one race or one nationality over another has long been a subject of controversy. We like to think we are better, or our family is better, or our school, church, state, nation, or race is better than others. This will to believe sometimes leads us into strange and unconvincing attempts to explain facts.

Many investigators have given intelligence tests to members of different races. But there are two main difficulties that stand in the way of a final decision on the question of whether there is "racial superiority" in intelligence—difficulties which make impossible the exact measurement and comparison of the intelligence of different races and nationality groups.

First, an investigator can measure the intelligence of only a sample of each group. Here arises the possibility of errors of selection. Do you have a true cross section of all the elements in the particular group? How does the investigator find "average members" of different "races" to test?

The second great difficulty of testing racial intelligence is that there must be adequate control of all the significant variables—of all the factors other than innate intelligence which might influence the results of the test. The most important of these variables are:

1. *Language.* It is obviously unfair to expect people to do well in a test which is not in a

familiar language. The use of a test in English would have been a handicap for the Ceylon college students if they had not learned English in childhood and used it as a second language.

2. *Physical environment.* One paper and pencil test given to Samoans gave misleading results because the children had never seen pencils.

3. *Habits of performance.* An appreciation of the difficulties encountered in testing some American Indians, for example, can be garnered from the following instances of the influence of tradition: in one group it was considered very bad form to answer a question while anyone who did not understand it might be present; there was also such a strong desire for certainty that guessing was unthinkable; and to do anything hurriedly was regarded as "bad manners" (Klineberg, 1928, 1935). In other societies where there is strong community spirit, natives never understand that the test is not a common venture to be discussed and solved cooperatively. The habit

of leisurely living, with no emphasis on speed, may handicap members of other cultures in taking a speed test. This factor may enter into test results with such groups as the reservation Indian and the Southern Negro (Geist, 1954). In the Ceylon University study, a power test rather than a speed test was purposely used to avoid any handicaps from the unaccustomed need to hurry.

4. *Kinds of experience.* As we have already seen, the different social experience of members of different groups makes it very difficult to devise test items that will truly reflect the subjects' intelligence instead of being a measure of their particular types of experience. When testing a group of illiterate draftees to see if they would be capable of learning to read, one examiner asked the question, "If you had \$11.00 and went to the supermarket and spent \$7.00 for groceries, how many dollars would you have left?" One draftee replied, "No dollars." When the examiner repeated the question and tried to explain it a little more fully, the draftee again replied,



Devising an intelligence test that will achieve valid results for all socio-economic groups in our culture—from suburbanites to farmers to tenement dwellers like those shown at left—is very difficult. Further complications arise when the test maker sets out to measure the intelligence of racial or nationality groups whose values and learning experiences may be vastly different from those in our culture. Most of our present tests, for example, would fail to measure the intelligence of the Eskimos shown at right.

"No dollars. My wife would take the other four dollars, to keep me from going out and getting drunk with it."

In order to make a fair comparison between different racial groups, as between different socio-economic groups, the subjects must be given tests of comparable difficulty which contain test items on topics equally familiar to all the examinees. It may be necessary, then, to adjust the form of questions given to one group in order to fit the experience of other groups. This raises a further problem—that of determining just what changes can be made without affecting the content or relative difficulty of the test.

The question of whether or not the Negro is lower in intelligence than the white man has been of particular interest in the United States. It is true that Negroes in the South tend to make lower scores on most intelligence tests than whites. In fact, one investigator, in testing the intelligence of a representative group of Negro school children in Virginia, found the average I.Q. to be about 75 rather than the usual white average of about 100 (Hammer, 1954). This does not mean, however, that the Negro's inherent mental ability is inferior to that of the white person. We have seen that intelligence tests tend to be culturally biased and therefore would not be surprised to find that they do not always give a fair picture of Negro ability. Furthermore, it may well be that emotional difficulties, caused by their being a minority group, account for the inferior performances of Negroes in many cases.

That the I.Q. will tend to rise as the environment is improved has been dramatically shown in a recent study of Negro children who moved to Philadelphia from poor environments in the South (Lee, 1951).

As early as 1935 Klineberg had stated that the higher I.Q.'s of Northern Negroes were due to improved environment rather than to the fact that the most intelligent Negroes were the ones who moved to the North in the first place. But Klineberg had merely tested various groups of individuals who had lived in the North for varying lengths of time and had never tested the same group more than once. Lee wished to check the hypothesis more carefully by retesting the same group. Because Philadelphia gives the same set of tests of mental ability to the children in its schools every year, it provided Lee with an ideal city in which to work. Choosing nine

schools with varying percentages of Negro students and with students from various economic levels, he studied the record of every Negro student from the South. To provide a control group, he took every fifth Philadelphia-born Negro who had not attended kindergarten—since the Southern students would not have had kindergarten training. Mean I.Q.'s of the migrant and control groups were recorded at the 1A, 2B, 4B, 6B, and 9A grade levels.

In every case the group entering the Philadelphia schools during the first year of the study was lower in I.Q. than the Philadelphia-born Negroes of the same grade. But every migrant group showed steady improvement from year to year. The group who entered the Philadelphia schools in 1A had a mean I.Q. of 86.5 at that time, and on the 9A test this group had risen to a mean of 92.8, which was virtually equal to the mean I.Q. of the Philadelphia-born 9A group, 93.7. The Philadelphia-born group had made a mean I.Q. of 92.1 on the 1A test. If the improvement had been due to practice in taking the tests from year to year, the Philadelphia-born group would have improved also, but instead they remained practically stationary while the Southern-born group was forging ahead. Also, all the various factors, or primary mental abilities, tested showed steady improvement (except memory, in which random improvement was shown), so that no one factor was responsible for the higher scores. Evidently the improved environment of Philadelphia was responsible for the increase in I.Q. displayed by these Southern-born Negro students.

In general, we may say that the whole problem of whether there are *inherited* differences in intelligence among races is one that is far from solved. Some investigators have the belief (cf. Klineberg, 1940; Benedict, 1943; Freeman, 1934) that these differences are not entirely inherited but are due in large part to differences in environment and would probably disappear if all races lived in comparable environments. However, their belief has never been conclusively proved or disproved because of all the difficulties involved in making an intelligence test that is known to be fair to people in cultures different from that of the test maker.

For the present the important facts about the comparative intelligence of different racial groups are these:

1. Although our present testing procedures reveal differences in the average intelligence of different groups, there is considerable overlapping between groups. In other words, the

most intelligent members of one group are more intelligent than the average member of any other group.

2. All degrees of intelligence are found in all groups, just as the various physical characteristics of mankind are found in differing degrees in all the various ethnic groups.

SPECIAL FACTORS IN INTELLIGENCE

Psychologists know that there are several special factors—besides the general factors of heredity and environment—which help explain the development of intelligence. Some of these can be regarded as particular patterns of interaction between heredity and environment. On the other hand, there are many special factors which, contrary to popular belief, have no bearing upon intelligence at all.

Birth order and size of family. A comparison of the scores of 5928 pairs of siblings revealed that the first-born children were slightly inferior in I.Q. to those coming later in the family (Steckel, 1930). Since there is no known hereditary mechanism accounting for this fact, it must be attributed to environmental effects, probably to the fact that younger children are stimulated by and compete with older ones. In any case the difference was too slight to have practical significance.

Some evidence of the effect of family size on intelligence has been obtained from studies conducted in England (Nisbet, 1953).

The investigator found that the verbal aspect of intelligence was adversely affected by large family size. Working with a group of about five thousand children he found that, when intelligence as a whole was held constant, the size of family had a negative correlation with an English test used as a measure of verbal proficiency. His theory was that in the larger families the parents had less time to tell or read stories to their children and in other ways to stimulate the growth of verbal ability. (Such environmental factors, however, only partially explain the development of ability in using words—recall the Blewett study on identical and fraternal twins, page 100.) A follow-up of the English study found that the effects of family size persisted to some extent even into adult life (Scott and Nisbet, 1955).

Month of birth. A number of studies have analyzed the intelligence test scores of large

numbers of individuals grouped according to their month of birth. A few such studies have shown slight but consistent superiority in the intelligence test scores of individuals born in the warm months of May, June, July, August, and September (Held, 1940). Two hypotheses have been advanced to explain this apparent difference.

First, it is quite possible that a selective factor influences the results in favor of children born in warm months. Because children born during the winter come of school age around mid-term or after, they are a little older upon entering school and, at a given age, have had a little less schooling; hence they might have a little lower I.Q. This hypothesis has not yet been proved but should be kept in mind as a possible explanation of the relationship between month of birth and level of I.Q.

Other studies seem to support another hypothesis: that parents of superior intelligence are more likely to plan births for summer, when the newborn have a better chance to get a healthy start in life than do babies born in the cold months; and that the slight superiority of children born in the warm months may be explained in this way.

The months of birth of 3275 children were tabulated by parents' occupation. In the upper-income groups, the birth rate was higher during the warm months. On the average, the children of upper-income groups were brighter than children of the lower-income groups. Since seasonal variation in birth rate was not found among the children of poorer parents (who were presumably less likely to plan the births of their children), it was concluded that superior intelligence of parents rather than seasonal influence was responsible for any superiority in the intelligence of children born in the warm weather months (Goodenough, 1940).

One recent investigator, feeling that previous tests on the effect of month of birth were unsatisfactory for determining whether or not adult intelligence was affected, determined to conduct a different type of experiment.

Previous studies had nearly all been based on group tests administered to children, and in some cases scores from several different tests were combined to obtain the results. The present investigator felt that sustained attention and effort, so important to accurate results, could only be obtained in indi-

vidual tests. He gave the Wechsler-Bellevue Adult Intelligence Scale, an individual test, to 1397 adult males of all ages who had varying amounts of education. He found that those born in March had the highest mean I.Q. (101.49) but this was only about four points above the lowest mean, found among those born in February. Thus the difference was so small as to be insignificant. When the subjects were grouped according to season of birth and as to period of birth (warm or cool month period of the year), it was found that those born in the spring were slightly superior and, in contrast to most studies of children, those born in the cool months had a higher mean I.Q. However, the differences were again so small as to have no real significance (Lewinski, 1954).

All in all, there is no scientific confirmation of the belief that the month or season of birth influences I.Q.

Health. There has long been a popular notion that the child who is superior in intelligence will be inferior in physical health, and vice versa. People like to feel that nature balances things out—a good mind against a weak body. Numerous studies show that this belief is false and indicate that superior heredity is a factor in both mental and physical superiority.

An intensive study was made of the health and physical characteristics of the large group of gifted children in the Terman study already mentioned (pages 98-99). The superior children were compared with the mentally average group and were found to be better on the average in every desirable trait. The children of average intelligence suffered from more physical illnesses and possessed more bodily defects than those of superior intelligence (Terman et al., 1925).

Malnutrition and intelligence. How does malnutrition affect I.Q.? In any attempt to deal with this relationship, one must be on guard to see that all experimental variables have been accounted for. For example, it is well established, as we have seen, that poor children on the average score lower on intelligence tests than children of well-to-do families. The poorer children are also less well fed. This lower intelligence of the undernourished children might possibly result from the poor nourishment they have received, but it could just as well be the result of poor heredity or lack of intellectual encouragement at home.

The best way to find out whether nourishment is related to intelligence is to take a group of malnourished children and see if their intelligence changes when their nutrition is improved. Numerous studies have been conducted on this important problem but with negative results. The conclusion is that correcting a condition of malnutrition will make the individual more active and happier, but it will not raise his I.Q.

A study of 2400 maternity clinic patients indicated, however, that a child's intelligence may possibly be affected by his mother's diet during pregnancy.

Part of the women in this study lived in the mountains of Kentucky; the others were slum dwellers in Norfolk, Virginia. For the purpose of the study the women from each locale were divided into four groups—three receiving various types of vitamin supplement and the control group receiving tablets composed of inert material. When the children of these mothers were given intelligence tests at the age of three, it was found that the children of the Norfolk mothers who had received vitamins had an average I.Q. that was 3.7 points above the children of the control group; at the age of four they surpassed the control children by 5.2 I.Q. points. No significant differences in average I.Q. were found between children of the vitamin-taking mothers and the control mothers in the rural Kentucky area. However, the mountain women were eating a much more healthful diet to begin with than were the slum-dwelling women. Furthermore, they were not so closely supervised and may not have taken their tablets as faithfully. Their resentment of interference by outsiders also made it difficult to obtain reliable test results (Harrell, Woodyard, and Gates, 1955).

On the whole, the results of this study can be accepted as indicating that prenatal nutrition may have some effect on intelligence.

Glandular imbalance and intelligence. As we saw in Chapter 2, the endocrine glands produce chemical substances which profoundly affect both physical growth and personality development. The exact relationship between intelligence and these internal secretions is a tremendously complex problem which scientific research is only beginning to solve.

One line of investigation has attempted to discover the relation between intelligence and undersecretion of the thyroid. When a

once healthy thyroid gland fails to deliver an adequate supply of thyroid secretion, intelligence declines and the individual becomes lazy and dull in manner. These conditions usually can be corrected with thyroid treatment. But a thyroid deficiency early in life, resulting in cretinism (page 48), interferes with the initial development of intelligence and therefore is much more serious. Treatment with supplementary hormones usually brings some improvement, but about 75 per cent of such cases never achieve normal intelligence.

Although a very definite relationship has been found between thyroid deficiency and lowered intelligence, there is no adequate evidence that disorders of the pituitary have an adverse influence on intelligence (although they do have a harmful effect on social behavior in many instances). In fact, there is some evidence to indicate that patients with a severe pituitary deficiency (Fröhlich's syndrome) may actually be superior in intelligence to the average (Schott, 1938).

Diseased tonsils and adenoids. How often has the family doctor assured the worried mother that Johnny will do better in school when his infected tonsils or adenoids are removed? Although removal of diseased tonsils and adenoids may have many beneficial effects, careful experiments have proved that it has no influence on level of intelligence (Rogers, 1922; Lowe, 1923). Any improvement in a child's health, of course, will make it easier for him to work up to his full mental capacity.

Premature birth. A common belief is that premature birth is a handicapping event in the life of the individual and likely to cause a permanent mental deficiency.

A recent study of the mental ability of ninety-nine prematurely born children of early school age found that there was no difference between this group and the normal population either in average score or in the variability of the scores (Knehr and Sobol, 1949).

Another study, conducted on only twenty-two infants, also showed no correlation between degree of prematurity and intellectual capacity. The general conclusion was that unless the brain is injured at birth, prematurity has neither a beneficial nor a harmful long-range effect on intelligence. However, over half of this group of prematurely born children

were below average in their emotional adjustment. Part of their difficulties might be traced to the rigid schedules and lack of loving human contact which they had to undergo immediately after birth, as a necessary part of their lives in incubators. Furthermore, their parents had tended to be overprotective and to continue to regard them as fragile and delicate even after they left the incubators. In one case the parents had worn sterile masks whenever they were near their boy until he was six months old and continued to be overanxious about him as he grew into childhood. Although he had high ability, he was unable to make good use of it because of emotional difficulties caused by this overprotective treatment (Howard and Worrell, 1952).

Thus it may be that prematurely born individuals, though intellectually equal to others, are often handicapped emotionally by their very earliest experiences and by being overprotected during childhood.

Sex differences in intelligence. Two surveys of large numbers of boys and girls of junior high school age leave little doubt that sex differences in intellectual capacity do exist.

In a study in which primary mental abilities tests (page 73) were administered to three successive junior-high classes in Brookline, Massachusetts, it was found that the boys surpassed the girls markedly in (S) space, whereas the girls clearly surpassed the boys in (M) rote memory, (R) reasoning, and (W) word fluency. On (V) verbal comprehension, the boys did somewhat better than the girls on two of the three tests. No difference in (N) number was found between the two sexes (Hobson, 1947).

In another study the Thurstone battery of primary mental abilities tests was given to all the thirteen-year-olds in a midwestern community of 6000 inhabitants. It was found that the girls excelled the boys in number, verbal fluency, reasoning, and memory. The boys excelled the girls in space. No significant difference was found on the verbal comprehension test (Havighurst and Breese, 1947).

✓ A recent study of college students has indicated that men are superior to women in solving problems which require ingenuity and logic (Sweeney, 1953).

Putting together the results of these studies, it seems reasonably safe to conclude that boys excel girls in *spatial intelligence* and most kinds of problem solving, whereas girls excel boys in *word fluency, reasoning, and memory*.

The evidence is not clear as to the direction of superiority in *verbal comprehension* and *number*. A great deal more research is needed in this whole area.

OTHER ABILITIES

Our discovery that intelligence itself is composed of several specific abilities leads us to ask: What about a musician's abilities? Or an athlete's? Few would argue that a great musician, athlete, or artist does not have some special ability or abilities other than intelligence. Are these general abilities, or can we expect to find varying patterns of more specific abilities?

ATHLETIC ABILITY

Is there such a thing as all-round athletic ability? We know that certain individuals excel in a large number of sports, while others fail in all. We cannot assume on the basis of this fact alone, however, that there is a general athletic ability that makes for excellence in all sports. Even if correlations between the various athletic abilities were zero, it would be possible for a few individuals to excel in all of them through chance association of the desirable abilities. We must not attempt to answer this question by thinking of an exceptional person who may or may not follow the rule but must examine a cross section.

A number of studies have been conducted in this area making use of the method of factor analysis. Positive correlations have been found between tests of athletic proficiency, indicating that these abilities are somewhat interdependent (Brogden and Harman, 1948).

Several studies have suggested that there are probably three independent abilities entering into athletic performance: strength, quickness, and steadiness (Seashore, Buxton, and McCollom, 1940). In addition, a variety of studies conducted by Air Force psychologists indicate that complex motor tasks typically contain the space factor (S), discussed on pages 73-74. One British study found a general or basic factor for athletic ability, highly correlated with general health, plus three subfactors—running, jumping, and throwing (Highmore and Taylor, 1954).

The type of power involved in jumping has been studied to determine its relation to intelligence and general athletic ability by two American investigators.

A "jump and reach" test was used on 1013 high school boys, the best of three jumps being counted in each case. Each boy stood facing a board on which horizontal lines were marked one inch apart and extended his arm upward as far as he could. Then he was asked to jump and reach as high as possible. The difference between the height he could reach standing still and the height he could reach jumping was his score. It was found that jumping power had no relation to intelligence. However, the lettermen of the group, regarded as "athletic," made significantly better scores than did the non-athletic members of the group, suggesting that the kind of power measured by the jump and reach test is an important component of athletic ability. This type of power is more highly correlated with achievement in track, swimming, basketball, and baseball than with boxing and wrestling or tennis (Burley and Anderson, 1955).

These studies show that a person who excels in one type of athletic activity is likely to excel in others too. Apparently there is such a thing as all-round athletic ability.

MUSICAL ABILITY

An early study reports the correlations between measurements of pitch discrimination, sense of time, tonal memory, and many others (Seashore and Mount, 1918). These elements represent essential abilities in learning to play musical instruments. Their intercorrelations were found to be so low that we find no evidence of a cluster representing general "musicality." All in all, the evidence from this early investigation and from more recent ones indicates that there is no such thing as all-round musical ability. Good musicianship, rather, seems to depend on the individual's being strong in several basic abilities.

The fact that an individual is high in a few of these elementary abilities does not mean that he will be high in the others. Certain of the needed abilities of the musician, however, tend to go with certain others. People who are good in discriminating pitch, for example, are likely to excel in memory for combination of tones and, of course, in ability to sing a particular note at will. Rhythm, however,

does not seem to be correlated with pitch discrimination. The senses of pitch, intensity, time, consonance, rhythm, and memory for tones are all unrelated to general intelligence (Fracker and Howard, 1928; Ross, 1936).

MECHANICAL ABILITY

The earliest dependable information on this important subject can be drawn from the results of the Minnesota Mechanical Ability Investigation, conducted by five psychologists working in close cooperation.

In this extensive investigation a battery of tests was given to groups of subjects and the results analyzed by statistical methods. The psychologists discovered six tests of mechanical ability which showed high correlations with success in such work as electrical wiring, manual training, and shop practice. These six tests were all correlated positively with each other. In other words, evidence was obtained that there is all-round mechanical ability.

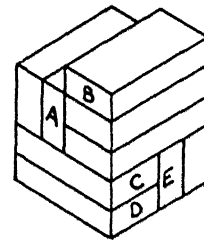
The Minnesota study found no correlation, however, between general intelligence and mechanical ability. People rating high in the cluster of mechanical abilities can be found about equally among those who are high or low in general intelligence (Paterson *et al.*, 1930).

It is interesting to learn that general mechanical ability does not correlate with steadiness of the hand. Hand steadiness is measured by a simple apparatus which consists of a metal plate in which nine holes of differing sizes are drilled. The subject attempts to place a needle in the holes without touching the sides of the holes. The score is determined by the number of times he touches the sides of the holes in putting in the needle and holding it there for a few seconds. The size of the hole determines the difficulty of the task.

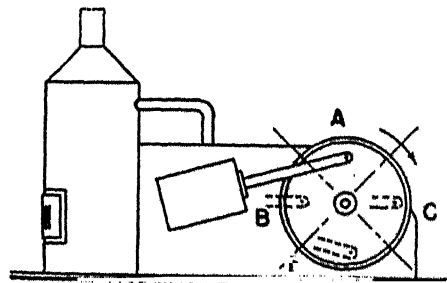
Another widely used test of mechanical ability is the Bennett Test of Mechanical Comprehension. Here the person taking the test must choose between drawings illustrating mechanical principles. For example, one of the practice problems shows two differently furnished rooms, one containing heavy draperies and rugs, the other having neither rugs nor curtains. The subject is to indicate which of the rooms will have the greater amount of echo. The test has several forms, including a special form for women which contains pri-

marily pictures of household utensils and appliances. The most difficult form, developed in collaboration with Owens, is illustrated at bottom. It has been found valuable in predicting the success of engineering students (Owens, 1950).

One interesting discovery made in connection with the Bennett Test was that its Form AA (not the women's form) had a high correlation with the Terman-Miles inventory for measuring masculinity-femininity (Lee, 1952). Men perform significantly better on the Bennett Test—so much so that it predicts the masculinity-femininity rating as well or better



The sample problem above is from the Space Visualization Test (Grimsley *et al.*, 1956), which measures ability to perceive and manipulate spatial relationships. All of the blocks in each of the piles are the same size and shape. The subject must look at each lettered block and determine how many other blocks in the pile it touches. The correct answers for the above problem are six for A, one for B, five for C, two for D, and six for E.



Through which quarter turn is the most power applied to the flywheel?
(If no difference, mark E.)

The Owens and Bennett Mechanical Comprehension Test, Form CC, consists of sixty problems similar to the above sample. The subject picks the *one* best answer from the five possible answers given for each problem. The correct answer for the sample shown above is A.

than it does performance in actual mechanical jobs in most cases. This discovery may have great practical value. Often it is necessary to know whether job applicants are primarily masculine or feminine in their interests and emotional reactions. Since self-inventories can be "faked" to quite an extent, a non-fakable test based on abilities is needed. It is possible that such a test might be constructed by using items from the Bennett Test and from the Minnesota Clerical Test (also included in the above study), on which women make noticeably better scores than men.

ARTISTIC ABILITY

Artistic ability, like musical and mechanical ability, seems to be independent of general intelligence (Meier, 1942). Although there have not been enough studies in this area to answer the question of whether there is all-round artistic ability, there is some evidence that creative artistic ability, as indicated by ability to draw, is correlated with art appreciation.

Over a six-year period the Meier Test of Art Appreciation, illustrated below, was given to groups of college students in a laboratory psychology class. A total of 194 subjects were tested altogether. The students were also asked to draw a large silver-plated elephant which was set up against a black background before the class. Twenty minutes were allowed for the drawing, and the students were urged to use the entire time and to do the best they could even though they were sure they could not draw well. Some students had had more art training than others.

The drawings were evaluated by the students themselves and by three art experts. A correlation of .587 was obtained between drawing ability, as

rated by other students, and performance on the Meier Test of Art Appreciation. A correlation of .369 was found between the experts' ratings of the student drawing and the same students' scores on the Meier Test. This would seem to indicate that art appreciation is not entirely independent of drawing ability (Crannell, 1953).

This correlation might partially be the result of learning, since students with training in studio art would also be likely to have some training in art appreciation.

For none of these abilities—athletic, musical, mechanical, or artistic—have there been definitive studies on the relative roles of heredity and environment, such as those carried out in the area of general intelligence.

GROWTH AND DECLINE OF HUMAN ABILITIES

Do human abilities reach their peak fairly early in life and then start to decline? This question has more than mere academic interest in our society, where the number of citizens over sixty-five is increasing all the time, but we do not yet have a conclusive answer to it. We can think of many examples of individuals who have made brilliant intellectual contributions while in their seventies or eighties. In our government the Supreme Court justices command the highest respect and wield great power. Surely the intelligence of such older persons has not decreased markedly. Are they rare exceptions to a general rule of decline, or is the apparent intellectual deterioration of many elderly

In the Meier Art Judgment Test the subject looks at a series of one hundred pairs of pictures and indicates which picture in each pair has, in his opinion, the greater amount of esthetic appeal. After the subject has judged the entire series of pictures, the experimenter tabulates the responses and determines his centile score. In the pair shown, the correct choice is the picture on the right, which has more balance of parts and greater harmony between the background and the stress of the figure.



Prime of Life for Various Sports

<u>type of performance</u>	<u>ages of maximum proficiency</u>
professional football	23-27
professional ice hockey	24-28
professional tennis	25-29
championship rifle & pistol shooting	25-29
championship billiards	25-29
professional baseball (batting)	26-29
heavyweight boxing	26-30
professional baseball (pitching)	26-31
championship golf (open)	27-31
championship corn husking	27-31
bowling	30-34

persons actually a decline in physical functions, visual acuity, and the like? A lessening of opportunity for intellectual activity may also be a factor, since our society on the whole has offered its older people no very useful role.

THE PRIME OF LIFE

Actually there is no one prime of life. The exact age at which maximum development is attained depends upon the nature of the task under consideration. Simple performances attain their maximum early in life; complex ones grow more slowly. A young child walks about as well as he ever will, but his ability to talk (as measured by the size of his vocabulary) will increase fairly steadily until middle age. Many skills that are complex and can be improved with practice seem to develop to their fullest in the mid-twenties, which is the prime of life for most types of motor performances. Beyond the point of prime, increases in age seem to bring a decrease in ability to improve with practice. These losses in learning ability are not important between the ages of twenty and forty-five or fifty years, but as the individual enters old age, learning becomes more difficult.

The fact that maximum proficiency in various skills develops at different ages has been clearly demonstrated by a recent study of several thousand outstanding performers in a number of athletic activities (Lehman, 1951). The chart above summarizes some of the findings of this study. It is important to note that only outstanding performers, many of

them champions, were considered in this study. The reason for limiting the study to performers who displayed a high degree of skill is that few people ever actually reach the very peak of performance within the bounds of their capacity. Most human beings are content to rest at some point below their maximum potential performance, whereas athletic champions attain an exceptional level of performance not only because they have great innate capacity but also because they have devoted enormous periods of practice to developing that capacity to the fullest. It is only among champions that we see an individual's capacity expressed to the level of his maximum possible proficiency.

METHODS OF STUDYING GROWTH AND DECLINE

In studying the growth and decline of human abilities we use two basic methods—the *longitudinal* and the *cross-sectional*. Each has advantages and disadvantages.

The cross-sectional approach. In the cross-sectional approach the subjects are grouped by different ages. This method makes it possible to use one set of tests that have a wide enough range of difficulty to permit testing the young, middle-aged, and old alike. There remains the problem (also encountered in the longitudinal method) of obtaining tests that are equally fair to all age groups. Older persons are further from their school days than younger ones and have had more opportunity to forget. Thus, since most intelligence tests correlate highly with school learning, the older subjects are penalized. Another difficulty involved in making tests equally fair for all age groups is that of controlling the content for cultural changes. For example, grandfather is more likely than grandson to be able to answer this item, taken from the famous "Army Alpha" group examination of World War I: "Carrie Chapman Catt is known as a: singer, writer, nurse, suffragist."

One of the most important difficulties in cross-sectional studies is that of sampling the population at various ages in such a way that each sample is representative of all individuals of the same age. Obviously school populations cannot be used exclusively, especially after the age of compulsory attendance. It is well established that the less able students lag behind their class and tend to drop out

earlier than the more able. The higher the grade level, the stronger is the action of this selective factor.

The best studies that employed the cross-sectional approach have used subjects reached outside of the schools.

In one of the earlier studies of this nature, practically all of the inhabitants of a New England village between the ages of ten and sixty years were tested. The village was selected as one in which there was great stability of population, few leaving and few coming from the outside. Of course, even in a situation of this sort, the age of death exerts a selective influence since those of lower ability tend to die younger than those of higher ability, as we have seen in Terman's follow-up study on the gifted children in California (page 98). In this particular study (see charts on page 117), it was found that mental abilities grew in a fairly regular manner until the subjects were around eighteen years of age and that most abilities reached their highest peak between the ages of eighteen and twenty-one. Vocabulary and general information, however, grew until somewhere in the middle forties and declined more slowly than other measured abilities (Jones and Conrad, 1933).

Other studies have confirmed this latter finding, as we shall see.

Another difficulty in the cross-sectional approach is that it is very hard to equate the factor of motivation for the various age groups. Older people tend to feel that they already know as much as they need to know and hence are not likely to work as hard as the younger subjects, who are still under the influence of school discipline. When the subjects are chosen on a volunteer basis this motivation factor is particularly important, since the refusal of some subjects to take the test may make it impossible to obtain a true cross section of the population.

An example of a cross-sectional study in which the differences in motivation were at a minimum was one in which an intelligence test was given to about seven thousand temporary civil servants, ages twenty to sixty, from all educational levels. The one thing they had in common was that all had been displaced from their regular occupations because of World War II and had secured positions in a government department, where they were tested in order to be more accurately classified. The subjects were classified according to age in five-year groups

(20-25, 26-30, etc.) and mean scores were computed for each group. When these were plotted on a graph, the scores declined so regularly with age that the graph curve was a straight line. The single exception was the age group from 46-50, which for some unexplained reason did not decline so much. Using the data from this study and also from other studies which he read, the investigator concluded that intelligence shows a mean annual decline (or MAD) of about .026 to .027 sigma (Vincent, 1952).

Some investigators believe that these lower scores, which we must admit are typical of the performance of older people, may indicate a decline in certain visual and motor abilities rather than in intellectual acuity as such.

Two recent investigators tested the hypothesis that intelligence does not decline significantly from early to late maturity. They used the individual Wechsler-Bellevue scale in preference to the group tests which had usually been employed in the previous studies. Believing that the previous studies might have used inadequate samples of the population, since not all older people are willing to be tested, they decided to conduct their study on a prison population, where forced sampling would be possible. After studying numerous data that we need not go into here, they concluded that the intellectual ability of prisoners is almost identical to that of the general population.

The investigators took a random sample of intelligence scores made by prisoners of all ages from fifteen to seventy from the Guidance Center of the California State Prison at San Quentin, where the Wechsler-Bellevue Test was routinely administered to all inmates. The total scores declined with age, but surprising differences were noted in the various subtests. On the verbal material, the San Quentin inmates showed an increase of 9 per cent from age fifteen to seventy. Such performance items as block design and picture arrangement, which call for visual acuity and motor dexterity as well as insight, showed the fastest rate of drop. This would indicate that verbal and performance scores, both good indicators of intelligence, are affected quite differently by age. Three subtests—Comprehension, Similarities, and Digit Span—were relatively unaffected, and the investigators recommended that only these be used for between-age research. Verbal or informational tests and performance tests indicate the relative level of intelligence within an age group but do not afford a valid basis for comparison of young and old people.

The general conclusions of this study were that test scores of older people will vary in a downward direction if the tests contain visual and motor factors but in an upward direction if the tests contain material which depends on continued learning, such as vocabulary or information items (Corsini and Fasset, 1953).

Although this study supports the hypothesis that intelligence does not decline sharply with age, its results would be weakened if it were shown that being convicted of a crime is a selective factor—that the prison population is not, in fact, representative of the general population in respect to mental abilities.

The longitudinal approach. In the cross-sectional studies it is impossible to determine exactly the initial abilities of all the age groups—to be certain how the middle-aged and older people, for example, would have tested at the age of ten or twenty or thirty. Since this is the case, we can never be sure that the age groups selected for the study are fairly equated with one another.

The longitudinal method overcomes this difficulty by testing the same individuals at intervals during their entire life span or some portion of it. Such studies have seldom been attempted, however, for the practical difficulties are enormous. In the first place, an elaborate and permanent research organization is necessary to standardize methods of gathering and analyzing the data and to make sure that the standards are adhered to in each successive measurement. Another problem is that of keeping track of individuals as they move from place to place. The longitudinal method also requires numerous forms of whatever test is used so that the practice effect from previous testings does not obscure the effect of age itself. Alternate test forms must be equated for difficulty and contain similar but not identical materials.

Longitudinal studies of adults have been few and fragmentary, and a longitudinal study over the entire life span has never been conducted. The early years of life, however, have been studied in this way. These investigations have usually been conducted on children in school, who were readily available for testing. Since the studies were not continued beyond the high school years, the interesting question of when each particular kind of ability reaches its maximum point and how rapidly it declines in the average indi-

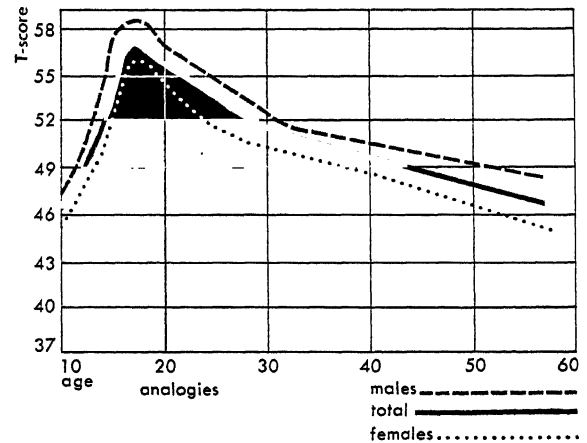
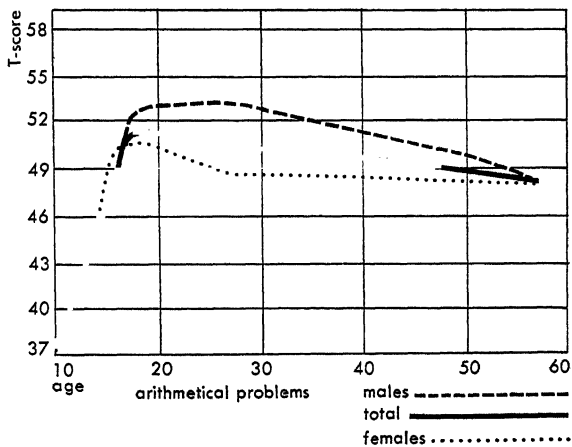
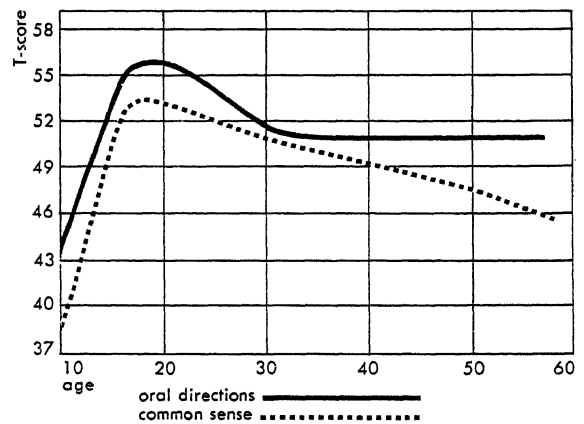
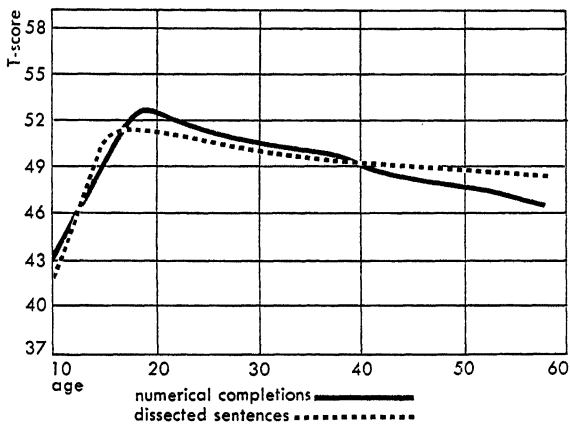
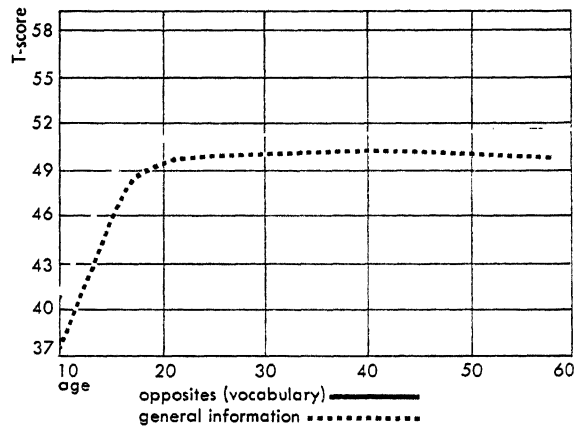
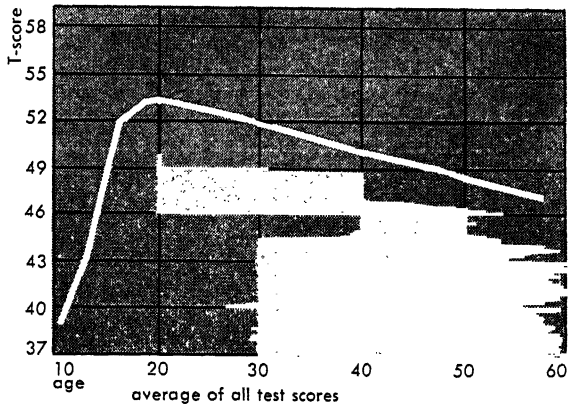
vidual has never been answered. If intelligence tests had been widely used for a hundred years or more, we should undoubtedly have a great deal more information. But it is only recently that large numbers of individuals tested as children have become old enough to act as subjects for follow-up studies of mental ability in middle-aged or elderly people. Within the next several years many more systematic longitudinal studies of intelligence, or at least more follow-up studies, will undoubtedly be conducted.

One interesting follow-up study has been made. This involved the retesting, during 1949 and 1950, of 127 males to whom the Army Alpha Test had been administered in January 1919, as an entrance test at Iowa State College. About half of those retested were still living in Iowa, and a number of these took the test on the occasion of a class reunion banquet; the rest were scattered throughout the United States and its territorial possessions and were tested by examiners living near them. Both subjects and examiners were paid for their time. Each subject was also asked to fill out a "Personal Information Sheet" covering marital status, number of brothers and sisters, total education, area (urban or rural) in which he had grown up, yearly income, and other items which the investigator thought might show some correlation with the amount of change in the scores. Comparison of the 1919 test scores with those of students from twenty other colleges showed the Iowa State group to be a representative college sample.

On the 1950 retest, mean scores were higher for the total test and also for seven of the eight subtests. The exception was the subtest dealing with arithmetic problems, where the mean scores decreased slightly. A number of the items in the personal data sheet, including the number of brothers and sisters (a factor which has sometimes been thought to affect intelligence), had no effect on the amount of increase in scores. However, education was a significant factor. Subjects who had had over five years of college showed greater increases in their scores on the two tests than did those who had had less than four years of college. Even though the greater part of the gains may have been made during the college career of these subjects—for it has been shown that intelligence test scores do increase after four years of college—these men were able to maintain the level they had reached at the end of college and undoubtedly to increase their abilities still more as they acquired further information. Those who had migrated from rural to urban

Growth and Decline of Mental Abilities

The smoothed curves below show the growth and decline of mental abilities of the rural New England sample studied by Jones and Conrad (1933). The first curve (top left) gives the average of all the Army Alpha Test scores, while the other curves show the results of the individual subtests.



areas, either at the time of entering college or later, showed greater increases in their ability to reassemble disarranged sentences than did those who had always lived in urban areas, indicating that the greater stimulation of the urban environment probably had some effect. Subjects with higher incomes made greater gains on the number series and analogies subtests, while those with the greatest number of hobbies and recreational activities made the greatest gains on the information subtest.

It would be impossible to ascribe the higher scores on the 1950 test to practice effect, for, after extensive questioning, the twenty-six subjects who attended the reunion banquet were able to recall only one item from the original test, namely: "The number of a Korean's legs is—two-four-six-eight." Another thing that makes this study valuable is the high degree of motivation shown for both tests. In 1919 intelligence testing was relatively new, and the subjects were informed that grade-point average and future occupational status might be predicted from the results; hence they were undoubtedly motivated. On the retest the subjects' pride was involved. They wanted to show that they "had not slipped." Nearly all of those tested wanted to know the test results (Owens, 1953).

This longitudinal study, then, would indicate that most aspects of intelligence do not decline through middle age. It thus tends to confirm the findings of the cross-sectional study of prisoners discussed previously. Both studies show that performance on verbal tasks and on tasks subject to lifelong learning is likely to improve with age.

S U M M A R Y

In studying intelligence and other human abilities, psychologists distinguish between *ability* (quality or quantity of actual performance) and *capacity* (potential ability or "trainability"). Although recent investigations have shown that intelligence is really composed of several *primary mental abilities*, most research in this area has been in terms of *general intelligence*, expressed as an *I.Q.* The intelligence quotient is based on a ratio between an individual's mental and chronological ages and thus shows his rate of mental growth. Many studies have shown the relative *constancy of the I.Q.*—that is, that an in-

dividual's *I.Q.* will remain fairly stable unless environmental conditions change markedly.

Intelligence is distributed among the population in a *normal distribution curve*, with about half the population falling in the "average" range from 90 to 109. *Mental defectives* can be classed as *idiots* (*I.Q.* up to 25), *imbeciles* (*I.Q.* 26-50), and *morons* (*I.Q.* 51-70). Around *I.Q.* 70 there is a band of doubt where some individuals must be considered feeble-minded—that is, incapable of conducting their own affairs adequately because of low intelligence—whereas others are not. At the other end of the scale the *mentally gifted* have been shown not only to be superior in level of accomplishment and earning power but also to have lower death, insanity, and divorce rates than the average of the population.

In studying the factors that determine level of intelligence, psychologists have shown that *heredity* apparently is a much more important factor than *environment*. Changes in environment often do produce some changes in *I.Q.*, especially when a child is quite young, but the amount of improvement possible seems definitely limited by the individual's inherited capacity.

Although heredity is apparently the most important single factor in determining intelligence, various studies have shown that the development of specific abilities—such as verbal ability and number ability—is influenced significantly by *cultural factors*. This makes it very difficult to devise tests that are equally fair to all cultural groups. The problem is particularly troublesome when we try to compare the abilities of different races. The psychologist must try to get a *representative sample* of each racial group and to control such variables as *language*, *physical environment*, *habits of performance*, and *kinds of experience*. The available evidence, though far from conclusive, indicates that all degrees of intelligence are found in all racial groups, with considerable overlapping between groups.

Many special factors have also been studied as possible influences on intelligence. Among these *birth order*, *size of family*, and *glandular imbalance* seem to have some effect upon intelligence; but *month of birth*, *malnutrition*, *diseased tonsils*, and *premature birth* are apparently negligible factors. Several studies have indicated that there are probably some

sex differences among the primary mental abilities.

The discovery that intelligence is composed of several specific abilities has led to various attempts to analyze other human abilities. Thus far there has been no evidence of an all-round *musical ability* or *artistic ability*, but studies have indicated the probable existence of all-round *athletic ability* and *mechanical ability*.

To study the *growth and decline of human abilities* we may use either one of two methods. Both of them offer certain difficulties. In using the *cross-sectional* method, investigators need only one set of tests to study subjects of different ages, but it is difficult for them to obtain a representative sample of subjects, to

find tests that will be fair to all age groups, and to equate the factor of motivation for all groups. The *longitudinal* method, while making it possible to determine the initial abilities of all subjects, has the practical difficulty of requiring an elaborate research organization to gather and analyze data. Because a single individual is tested many times under this method, the investigator must use numerous forms of each test in order to avoid the effects of practice.

Studies using modifications of both methods reveal that there is no one *prime of life* for all abilities. Performance on tests containing *visual* and *motor* factors declines most rapidly with age, whereas performance on *verbal* and *informational* tasks may actually improve.

PART TWO

OVERVIEW

**DYNAMICS
OF
ADJUSTMENT**

In the first chapter of Part One we saw that psychology, like other sciences, is concerned with prediction and control and that psychologists have had to work out a number of new techniques appropriate to the observation and measurement of living organisms and their behavior. We saw how the experimental method works in the gathering of data to fit together into psychological theories and how, since not all psychological events are observable, psychologists must frequently employ logical constructs to describe the unseen parts. In the second chapter we saw how maturation and learning interact in the developing individual—how maturation limits an individual's capacity to adjust to his environment and how practice interacts with his capacity in determining his performance. In Chapters 3 and 4 we reviewed the many ways in which psychologists have tried to categorize and measure human characteristics and the way in which traits are usually distributed in the general population.

But no matter how carefully we trace the development of a person's abilities and other personality characteristics and no matter how accurately we measure them, we are still a long way from understanding his behavior. For example, you have often heard remarks like "Dave is so smart, I just can't understand why he doesn't accomplish more," or "With his intelligence and ability to get along with people, Tom is silly to worry so much." Or you may have said to yourself, "Why on earth did I do that? I knew better."

Obviously we still need to understand the motivation behind people's acts—to know what forces make them do what they do and what forces may hinder them from using their abilities to the full. This will be the concern of Part Two. In Chapters 5 and 6 we shall find that underlying every behavior pattern is a pattern of motives—a combination of interacting internal forces energizing and directing the individual's behavior along certain lines. Thus, although we respond to stimulation from outside us, our behavior is much more than a mechanical reaction to such stimuli. We all have drives and needs which in their own right propel us to action, and even responses to outside stimuli are affected by the pattern of drives and needs which is active in us at the moment.

Adjustment is a constant process of attempting to meet both our inner needs and the demands placed on us by our physical and social environment. In this process no human being can escape a certain amount of frustration and stress. But a person's mental health is determined not by the amount of frustration and conflict in his life but by whether or not he deals with them in a realistic and constructive way. Chapter 7 will examine the common sources of frustration and stress and the various types of defensive reactions, normal and abnormal, that people use in stressful situations. In Chapter 8 the purposes and methods of different types of therapy—and the personnel who administer them—will be described, together with the philosophies behind them.

CHAPTER FIVE

MOTIVATION



GOAL-DIRECTED BEHAVIOR

BIOLOGICAL DRIVES

PSYCHOLOGICAL AND SOCIAL DRIVES

What makes you search for food, water, or a place to rest when you are hungry, thirsty, or tired? Why do some men obey the law while others defy it? Why do some men energetically apply themselves to their work while others prefer to loaf? Why do some persons enjoy working and playing in groups while others remain alone and aloof from the crowd? The answer to each of these "whys" involves a problem in motivation.

Knowing why people behave as they do is useful in all walks of life. The experienced senator, for example, has a practical understanding of some of the social motives that concern man as a "political animal." The modern teacher makes learning easier and more effective by relating it to the students' interests and needs. The employer or supervisor is frequently called upon to apply his knowledge of human motives in his attempts to meet employees' basic personal needs, preserve industrial peace, and keep production at a high peak of efficiency. The advertiser appeals to the sexual appetite when he photographs a girl in a bathing suit along with his product. The wise mother knows that in dealing with her child it is better to appeal to the need for approval than to resort to force. We all appraise almost unconsciously the needs, interests, values, and emotions that make people act as they do. But when we say an individual is motivated in particular ways, what actually is happening, physiologically and psychologically, within the individual?

GOAL-DIRECTED BEHAVIOR

In any activity except simple reflex behavior, there are definite *motives*—that is, certain internal conditions—which serve to direct the organism toward certain goals. Motives may be inborn, learned, or a combination of both. If you think back over your own behavior during the day, you will see that all of it is directed toward some goal, if only the goal of enjoying a few moments' rest from pursuing other goals. When you first wake up, it may take a strong motive to make you leave your comfortable bed. Perhaps hunger pangs, aided by the stimuli which coffee and bacon present to your nose, impel you toward breakfast as your immediate goal. The smell of breakfast wins over the soft comfort of the mattress, and you go out to the dining room for food. A more complex aim which you are also striving toward is that of reaching your first class on time. This in turn involves such goals as passing the course, graduating from college, and even the long-range goal of entering a profession for which the particular course and the

college degree are essential. Thus human motivation is highly complex.

In this example we can see how motives serve to direct behavior toward goals in two ways: (1) by causing one external stimulus pattern to win over competing ones and (2) by causing the individual to seek external objects not present at the time. Any motivated act is complete when the goal is reached—in the case above, you have achieved your first goal when you have obtained your breakfast. The goal (also called the "reward" or the "incentive") is some substance, object, or situation which is capable of satisfying the persistent need or relieving the tensions created by that need.

When you achieve a goal, you do not become completely free from tensions, however, for as one goal is achieved, others are able to make more insistent demands. With breakfast over, you turn your attention to the need for getting to class. The achievement of one goal may even lead directly to the formation of

entirely new goals. In passing a course in elementary psychology, for example, you may acquire such a strong interest in mental disorders that taking a course in abnormal psychology becomes a new goal for you.

Your needs and goals will affect the way you perceive a situation. When you come home exhausted, you are relieved to find a chair to sit in. The next day you may see the chair as a means of climbing up to get your tennis racket from the top closet shelf. Or, if you have the phonograph on and are dancing, you may use the same chair to prop open the door to get better ventilation. It is evident that the same stimulus situation will not always be seen in the same way. The particular motive pattern affecting an individual at a given moment can greatly influence the direction his response to a given stimulus object will take.

In studying motivation we are concerned with how all the conditions associated with the various needs arouse and direct the behavior of the organism toward the satisfaction of those needs. Internal stimuli associated with needs can either initiate activity independently of external stimuli (as in hunger and in thirst) or combine their effects with those of various stimuli coming from the environment. Violent responses are often elicited by external stimuli which, although inadequate in themselves to create strong responses, may serve as a trigger to set off a charge of forces stored within the body. For example, a spoken or written word contains little energy when measured in physical terms. Depending upon its meaning, however, it may arouse terrific action on the part of the person who hears it spoken or sees it printed. Imagine seeing these headlines:

INVASION FROM MARS

INSECT-MEN TAKE NEW YORK

Reading these few words would involve only a small transfer of physical energy from the paper to your visual receptors, but it would arouse reactions of enormous intensity in any reader of normal intelligence and emotions. The implications of such news for yourself and for your friends would be vast; it would be exciting to some and stunning to others. Your reaction to the situation—whether it was searching for a place of safety, volunteering to help those affected by the catastrophe, or merely giving up in despair—would be deter-

mined largely by conditions other than the actual physical stimuli produced by the newspaper headlines.

The motives, or stimulus conditions, which direct our responses to objects in the environment fall into two main groups: (1) *biological drives*, resulting from such basic tissue needs as those for water, food, oxygen, and sleep; and (2) *psychological and social drives*, resulting from such needs as those for social approval, self-esteem, economic security, and greater knowledge. The biological drives are *innate*, although the ways in which an individual satisfies his tissue needs are greatly influenced by learning and cultural factors. The exact origin of our psychological and social drives is still a matter of lively debate, but most of them seem to be *acquired* as the result of experience.

Although the terms motive and drive are often used almost interchangeably, psychologists usually make a distinction between the two. A *motive* always directs the organism toward some incentive or goal which will satisfy a particular need. The term *drive*, on the other hand, is used more generally to refer to any internal stimulus condition of the organism which impels it to activity. Usually we think of drives as resulting from unsatisfied tissue needs, but the term may also refer to certain basic psychological and social needs. Indeed, almost any condition of the organism can function as a drive if it is sufficiently intense and enduring to arouse persistent behavior. In the next chapter, for example, we shall see how emotions operate as drives.

Although drives are usually associated with specific motives or goal-seeking behavior, they may also function more generally to instigate aimless activity. Thus laboratory animals deprived of food, water, or some other basic need often will enter an activity wheel and run. Psychologists interpret such behavior as resulting from the stimulus conditions created by an unfulfilled need—that is, as evidence of a drive. (See chart on page 125.)

BIOLOGICAL DRIVES

Biological drives originate in the undeniable biological requirements of the organism and consequently are often referred to as resulting

from *tissue needs*. These drives motivate the behavior of the organism in directions that lead to the satisfaction of those needs. For example, the hunger drive motivates the organism to seek and ingest food which is necessary to maintain metabolism. Prolonged failure to satisfy certain of the biological drives ultimately results in impaired health, disease, or even death.

Drives influence behavior from birth and are present even during fetal life, although normally at that time they are automatically satisfied by the mother's body. The biological drives are inborn—they arise out of inherited structures and are present in all people of all races as well as in the lower animals. The specific outlet and the sequence of actions which the individual employs to satisfy a particular drive, however, are generally learned.

Despite the importance of the biological drives to our health and happiness, they are by no means thoroughly understood, and investigation must be pushed much further before we will adequately understand these bases of human motivation. The drives which have been recognized and studied, and which we shall discuss here, include our needs for food (including a variety of specific substances), water, oxygen, rest, sleep, warmth when cold, coolness when hot; and the needs to relieve the sex drive, pain, and bowel and bladder tensions.

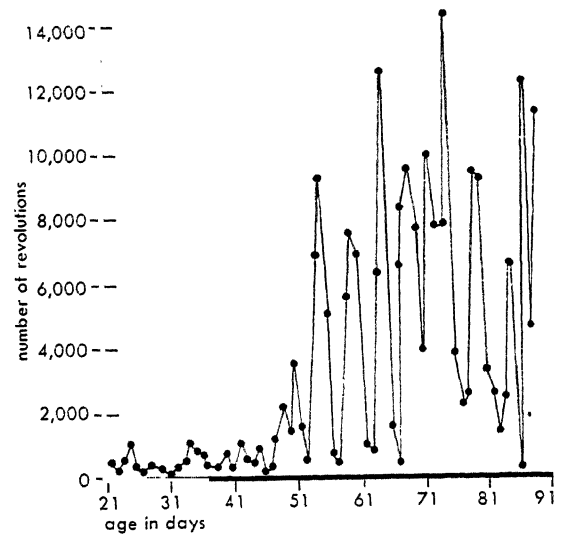
It is interesting to note that the intensity with which our drives are felt is in general inversely related to the length of time man can stand deprivation of them. We can go several weeks without food and several days without water, but we can go only a few minutes without oxygen and still live. Introspective evidence indicates that the strength of sensations aroused by the various drives *at their height* comes in just that order. Air hunger (as experienced in suffocation) is most intense; then comes thirst; then comes hunger for food.

BIOLOGICAL DRIVES

AS HOMEOSTATIC MECHANISMS

Though they vary in intensity, all of the biological drives are regulatory mechanisms which help maintain the physiological equilibrium of the individual. An organism will go to remarkable lengths to maintain "constancy of the internal environment." It strives,

Pubescent Burst of Activity in the Female Rat



Adapted from Richter, 1927

General activity usually increases and decreases with fluctuations of drive. The chart above shows the low level of activity in the female rat before puberty and the sudden pubescent burst, as measured by the number of revolutions run in an activity wheel. After puberty the normal female rat shows peaks of activity on days of sexual heat, running eight to ten miles on every fourth day but only a fraction of a mile on the intervening days. Pregnancy or castration will cause activity to plunge to a pre-puberty level.

often by means of interaction with its environment, to maintain stability of its normal, internal states. As we have already noted (page 45), this process is described as the principle of *homeostasis*. Failure of the organism to maintain physiological homeostasis will eventually result in sickness or death.

It is easy to understand how biological drives operate as homeostatic mechanisms when we consider that they originate in essential tissue needs—that is, in physiological conditions which have disturbed the organism's biological equilibrium. When an internal state is disturbed, tensions are produced which motivate the organism into seeking-activity that ceases only when the goal is attained and biological equilibrium is restored. As a simple example, when an individual is deprived of water for a period of time, the water level of his body declines and tensions associated with

the sensation of thirst arise. Consequently he becomes active, seeks water, and drinks, restoring his body's water supply to its normal level. This banishes the tissue need. Drinking activity and water-seeking activity cease until the individual experiences a renewal of the tensions associated with thirst.

Some homeostatic activities are largely internal and automatic. Among these are the maintenance of constant body temperature and of the proper balance of oxygen and carbon dioxide in the bloodstream. The maintenance of adequate nutrition also involves a great deal of involuntary activity. For example, by a very complex process the body maintains a constant level of sugar concentration in the bloodstream. To prevent too high a sugar level in the blood, the liver stores excess carbohydrates, which are released again if the blood sugar level falls too low (Morgan and Stellar, 1950). In Chapter 2 we noted also the extremely sensitive interaction of the endocrine glands, each one influenced to some degree by the activities of other glands in the endocrine system.

Voluntary activities of the organism also contribute directly to the maintenance of homeostasis. When a certain tissue constancy is first disturbed, the organism engages in activity to restore equilibrium—if it experiences the sensations of hunger or thirst, for example, it actively seeks food or drink to satisfy its need.

But such biological needs can never be satisfied permanently, and higher forms of activity have developed, particularly in man, to meet recurring disturbances in tissue constancy (Stagner, 1951). The organism perceives very small physiological changes as cues to a change in its equilibrium and thus can anticipate many of its needs. It also perceives environmental objects as potentially useful in forestalling discomfort. Thus animals build nests and hoard food for winter use. Men not only eat before hunger pangs actually begin but have developed highly complex systems of agriculture, food preservation, storage, and commodity exchange in order to ensure an adequate food supply at all times.

So we see that homeostasis is more than the automatic maintenance of chemical conditions of the body. It involves an active effort of the organism to establish a physical environment that is as constant as possible. Many of man's needs also require the maintenance

of a relatively stable *social* environment, but we shall discuss this phase of homeostasis a little later (page 140). First, let us consider the biological drives, which are basic to life itself.

THE HUNGER DRIVE

Of all the drives, hunger has received the most study. Yet the nature of the hunger stimulus—the answer to the problem of what makes people feel hungry—is still something of a mystery.

The hunger stimulus. From our own introspections of the gnawing sensations we call "hunger pangs," we know hunger as a mass of sensations resulting from internal changes in the region of the stomach. But just what changes in the condition of the stomach are associated with these sensations? And is the stomach the only source of hunger sensations? Let us examine the evidence.

Our understanding of the hunger mechanism has been advanced through the combined efforts of psychologists and physiologists who have performed various types of observations on the behavior of the empty stomach. One common method for studying stomach behavior is to have the subject swallow a thin rubber sack attached to a long rubber tube. The experimenter adjusts the sack in a position at the upper end of the subject's stomach and inflates the sack until it comes into contact with the walls of the stomach. The free end of the tube is connected with a recording device which makes a graphic record of any change of pressure in the stomach balloon. Subjects are trained to swallow the balloon and can sit comfortably for hours while continuous records of their stomach behavior are taken. Two types of stomach behavior are distinguishable from the records: that which is associated with digestion and that which occurs at the moment when acute hunger is introspectively reported. These latter movements, the hunger contractions, are the ones that interest us in our study of the hunger drive.

Physiologists have found that only the regular churning movements of digestion can be observed immediately after eating, but that as the stomach empties, hunger contractions set in. They appear about every hour and a half at first but come more frequently as the length of time without food increases. At first

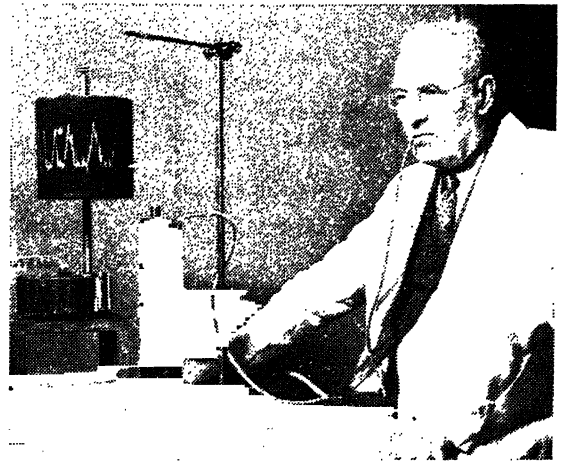
they are faint and do not always lead to conscious sensations, but with the passing of time they become stronger (Cannon, 1934).

It has also been discovered that the temperature of the stomach drops sharply when subjects first begin to feel hungry and rises again after eating. But this does not tell the whole story of the nature of the hunger drive. Evidence drawn from more recent experimental work indicates that the theory of hunger as a sensation originating in the contractions of the empty stomach is inadequate. Current indications are that hunger sensations have a plurality of causes—that stomach contractions are only one source of hunger pangs and not even a necessary one (Janowitz and Ivy, 1949).

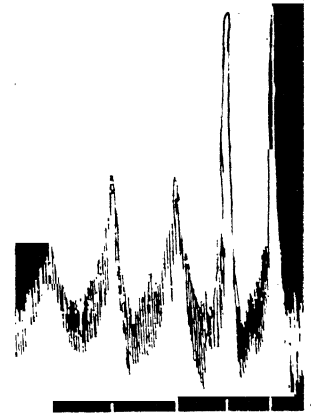
Evidence that hunger sensations are not necessarily due to contractions of the empty stomach comes from a study in which humans were kept on a semistarvation diet for several months. After a prolonged period of malnutrition, sensations of hunger were greatly accentuated. The subjects frequently reported feeling hunger pangs even when the stomach was full immediately after a large meal. Although hunger pangs under such conditions might be associated with stomach activity of some sort, it is obvious that they were not caused by emptiness of the stomach (Keys *et al.*, 1950).

Further evidence that stomach contractions are not necessary for the hunger drive to operate comes from a study performed with rats whose entire stomach had been removed. The startling thing was that the animals without stomachs showed hunger in practically the same way that the normal animals (used as a control group) did. They learned a maze when food was the reward just as efficiently as did the normal controls; they were equally active as feeding time approached. The only difference was that the operated rats became hungry more often than the control animals, which is reasonable since they had only their intestines for food storage and hence had to "stock up" on food more often (Tsang, 1938).

This evidence indicates clearly that the hunger drive can operate in the absence of stomach contractions. It may be that stomach contractions are merely a by-product of some basic condition in the physiological economy of the hungry organism and have no essential role in the hunger drive—although they are a useful signal of hunger.



The late Dr. Anton J. Carlson is shown above with the stomach-balloon apparatus which he developed. Pressure on the balloon causes the stylus to move up and down on the revolving drum, producing a record such as the one shown on the right.



Some findings suggest that the origin of the hunger drive is chemical in nature. Studies have shown, for instance, that blood transfused from the body of a starving dog to that of a recently fed one can cause stomach contractions under certain conditions (Luckhardt and Carlson, 1915; Tschukitschew, 1930). But these experiments will have to be carried much further before we can say definitely that hunger has a chemical basis.

The hunger drive, for all the study devoted to it, is still far from being adequately understood. There is, however, one known link in what may be a long chain of relationships involved in the physiological drives. This link is the hypothalamus.

Role of the hypothalamus. Whatever the factors are that produce hunger, they seem to operate through centers in the *hypothalamus*, a small structure at the base of the brain. It is

in direct contact with the cerebrospinal fluid and also contains more blood vessels than any other part of the central nervous system. The hypothalamus contains centers which excite a person to eat and others which make him want to stop eating when he has had enough.

In experiments with rats, investigators have found that when a certain part of the hypothalamus is disturbed surgically the animal will eat ravenously at first and then settle down to a steady habit of eating two or three times as much as a normal rat for a month or two until it reaches its maximum weight. It then eats more normally (Morgan and Stellar, 1950).

On the other hand, operations on a different part of the hypothalamus can cause an animal to stop eating permanently.

There is much evidence indicating that the hypothalamus also controls other drives, such as thirst, body temperature, and sexual desire (Stellar, 1954). It acts as a sort of clearing house of physiological motivation. (Some interesting details on this subject are presented in the Reference Manual on the brain and nervous system, pages 503-504.) Stimuli of all kinds—chemical, sensory, neural, circulatory—act on the numerous centers of the hypothalamus. Some of these centers excite behavior and some of them inhibit it. The way in which they “add up” the excitatory influences and “subtract” the inhibitory influences determines the strength and nature of motivation.

Hunger and the direction of behavior. The hungry organism is more than normally sensitive to its environment, or at least to those factors in the environment that are related to food. Hungry rats, for example, show a much greater reaction to changes in their environment—such as changes in lighting or sound—than do rats that are not hungry (Campbell and Sheffield, 1953). They show particularly great reaction to environmental changes that normally occur just before feeding time (Sheffield and Campbell, 1954).

Human beings have been found able to recognize pictures of food more readily when hungry.

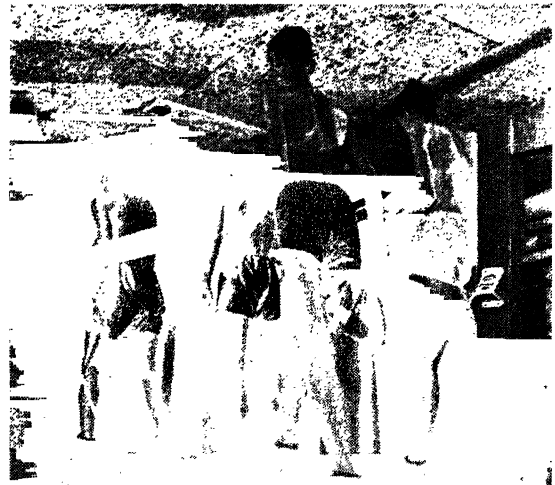
When 110 male college students were shown slides for very short intervals, half of them containing pictures of food and the other half pictures of miscellaneous objects, it was found that the subjects could recognize the food pictures more and more

readily during a three to four-hour period after eating—after which time they would normally have eaten again. After five or six hours, however, they no longer recognized the food so readily. This is consistent with the pattern which most people experience of being sharply hungry at mealtime but having their hunger decrease again if the meal is missed. The subjects' ability to recognize the non-food pictures in this experiment remained the same throughout (Lazarus, Yousem, and Arenberg, 1953).

Effects of starvation. The average well-fed American today has little difficulty in satisfying his hunger drive. At other times and in other places, however, the problem of finding adequate food has been a very serious one. According to the estimate of one scholar, China has had 1829 famines during the last two thousand years. India, too, has suffered many severe famines, especially during the nineteenth century. As recently as the winter of 1942-1943 the bodies of those who had starved to death in Calcutta littered the streets to such an extent that it was impossible to keep them removed (De Castro, 1952).

Conditions of famine often follow in the footsteps of war. The Allied invasion of Europe near the end of World War II liberated millions of famine victims, both civilians and war prisoners, who were in a condition of semistarvation. A sound program for rehabilitating these famine victims was hindered by the lack of a well-controlled study to determine the nature of the changes induced in man by semistarvation. This need was met by a group of scientists, under the direction of Dr. Ancel Keys, who conducted an elaborate experiment at the University of Minnesota (Keys *et al.*, 1950; Guetzkow and Bowman, 1946).

Thirty-six subjects, conscientious objectors who volunteered for the experiment, were used in the study, which was begun in 1944 and lasted nearly a year. The experiment consisted of three phases: (1) a twelve-week control period, during which the subjects received a well-balanced diet designed to represent the fare eaten under good economic conditions in the United States; (2) a twenty-four-week semistarvation period, during which the subjects were maintained on a diet characteristic of European famine areas; (3) a twelve-week rehabilitation period, during which subjects were carefully nourished back toward normal. The experimental semistarvation diet consisted mainly of bread, macaroni, potatoes, turnips, and cabbage. It provided only



During the semistarvation period of the Minnesota experiment, the hunger drive became the most important factor affecting the subjects' behavior, while the development of apathy was probably the most characteristic personality change. The emaciation which resulted is clearly evident in the photograph at right.

1570 calories a day as compared with an average of 3492 calories a day provided by the "normal" diet received during the control period.

Throughout the experiment the subjects were kept on a full-time weekly schedule of experimental routines. In addition to regular physiological and psychological checkups, each participant was assigned to fifteen hours of physical work each week, such as helping in the laundry or maintaining the living quarters. Each subject was also required to walk twenty-two miles a week out-of-doors and half an hour a week indoors on a treadmill. Another twenty-five hours a week were devoted to educational activities.

The physical changes produced by the twenty-four-week period of semistarvation were, of course, profound. Accompanying a 25 per cent loss in body weight was a 40 per cent decrease in basal metabolism and a 30 per cent reduction in body strength, which made a difficult maneuver out of an ordinarily simple task such as walking up a flight of stairs. The men became haggard, emaciated, subject to fainting attacks, and easily fatigued after the slightest exertion. Sexual urges decreased markedly and were slow to return during the rehabilitation period. Subjects "cooled" noticeably toward their girl friends and courtships collapsed. The men seemed practically incapable of displaying affection.

So striking were the personality changes which the subjects displayed during the experiment that the

authors of the study adopted the term "semistarvation neurosis" to describe the symptoms which appeared as a result of the semistarvation and then disappeared when the subjects returned to a normal diet. The outstanding characteristic of the "neurosis" was apathy. Humor disappeared, with a depressing air of gloom and dejection appearing in its place. There was also a marked decrease in sociability. The men became "nervous" and irritable, tended to be boorish and tactless when invited to parties, sometimes went unshaven and dressed sloppily, lost their cooperative spirit, and were inclined to "blow up" at each other. Self-confidence was replaced by feelings of inferiority and depression.

Tests of intellectual capacity administered at different times throughout the study failed to reveal any marked changes in intelligence as a result of malnutrition, although the subjects' general level of performance on such tests did decrease slightly. This lowered level of performance, however, may be attributed to general physical impairment. Because of their constant preoccupation with thoughts of food and their inability to concentrate on other things, the subjects worried considerably about declining in intelligence and believed that they were really suffering such a loss.

There can be no doubt that by the end of the semistarvation period the hunger drive had become the dominating dynamic factor affecting the behavior of the subjects in the Minnesota experiment.

Food, either directly or indirectly, dominated their conversation, reading, leisure activities, and daydreams. Over half of the men devoted their spare moments to reading cookbooks and collecting recipes. Others became intensely interested in such subjects as dietetics, agriculture, and frozen food lockers. Some subjects even gave serious consideration to the idea of changing their life occupations and becoming cooks.

Conscious sensations of hunger are much more insistent under conditions of semistarvation than with total fasting. After several days of complete abstinence from food, hunger pangs disappear almost entirely; but in cases of prolonged semistarvation, where a small but inadequate amount of food is available, the sensation of hunger grows increasingly until it almost entirely dominates the individual's consciousness and behavior.

✓**Specific hungers.** In addition to the general hunger drive, specific hungers often develop when the body needs certain substances. These hungers are particularly evident in the lower animals. Rats, for example, will usually select a balanced diet and show a preference for foods needed to make up a deficiency.

In a recent study twenty rats were fed a diet deficient in Vitamin A for twenty-two days, while ten control rats were given an adequate diet. At the end of this time a cup of compressed alfalfa meal, high in Provitamin A, was placed in each cage in addition to the regular diet. For fourteen days both groups ate about the same amount of the alfalfa, but after that the rats which had been deprived of Vitamin A ate larger and larger amounts of it (Harriman, 1955).

Human beings show some evidence of being able to satisfy specific bodily needs also. In infancy, at any rate, a human being may largely be trusted to prefer the foods that are best for him.

This was shown in a study where three newly weaned infants were allowed to select their foods from a wide variety of wholesome foods, both raw and cooked. Two of them selected their foods for six months, the other for a full year. All three gained normally and showed no signs of nutritional disorders. In fact, one baby who suffered from rickets at the beginning of the experiment cured itself by taking large quantities of cod liver oil, which contains the Vitamin D required to overcome rickets. The baby gave up the oil when the rickets disap-

peared. The babies tended to eat large quantities of one food for a time and then switch to another, going on "egg jags" or "cereal jags." But in the long run they obtained a balanced diet (Davis, 1928).

Primitive peoples also show remarkable wisdom in choosing foods which satisfy their needs, though their choices often seem bizarre to us. A typical Eskimo meal, for example, might include the skin of the white whale (as rich in Vitamin C as orange juice) or the vegetable content of diving birds' stomachs (Sinclair, 1954). The latter item is necessary to supplement their almost exclusively meat diet.

While most of our eating habits are formed in accordance with bodily requirements, many food preferences—such as the American taste for candy and cola drinks—are not in accord with the basic needs of the body. Thus the "wisdom of the body," though remarkable, may be overcome by acquired tastes.

THE THIRST DRIVE

Although man can live for many weeks without food, he can survive only a few days without water. As we have seen, nature has graded the intensity of these two drives accordingly. Men who have been completely deprived of both food and water for long periods of time report that the sensations of thirst soon become maddening, whereas pangs of hunger tend to disappear after a few days.

Effects of the thirst drive. Hunger and thirst not only differ in intensity but also cause pronounced qualitative differences in behavior, at least in the lower animals. In experiments with rats it has been found that thirsty animals learn to find a reward of water more quickly than hungry ones learn to find food when the rewards are in the same location, within a maze of passages (Petrinovich and Bolles, 1954). However, when the reward of food or water is placed first in one of two locations and then in the other, the hungry rats learn to alternate between the two locations more readily than do the thirsty ones. Thus the behavior of hungry animals tends to be varied, whereas that of thirsty ones tends to be stereotyped.

How thirst operates. The thirst drive is a regulatory device which serves to control the intake of water into the body in such a manner as to maintain the water content of the

body at a constant level. Exactly what all the factors in thirst are—just how the lowered water level of the body sets up the thirst drive—is still only partially understood by physiologists and psychologists.

One group of investigators has analyzed the thirst drive into four phases: (a) seeking water, (b) actually taking in water by drinking in response to the thirst urge, (c) stopping at a measurable amount of water, and (d) the absorption and distribution of water to the body tissues (Adolph, Barker, and Hoy, 1954). Two general stimuli—deficit of body water or excess of certain substances in body solutions—activate the first two phases through centers located in the hypothalamus. In phase *c* numerous factors, including distention of the stomach, operate to counteract the effects of phases *a* and *b* at least temporarily. The receptors for this phase are probably located in the stomach, throat, and tongue. Finally, as the water is distributed throughout the body (phase *d*), the receptors which had previously been excited by the condition of water deficit cease their activity. The precise nature and location of these receptors is not yet known.

Undoubtedly, dryness of the mouth and throat tissues is one important condition of thirst. As the water supply in the body becomes low, the tissues of the oral cavity become drier and drier, stimulating the tiny nerve endings embedded in them and producing consciousness of thirst. Yet dryness of the throat is by no means the only factor involved in thirst.

In one study dogs were deprived of water long enough for a water deficit to build up in their bodies. After this period of deprivation, an amount of water equal to the deficit was placed directly into the stomachs of the dogs without passing through the throat and mouth. After different lengths of time the animals were permitted to drink naturally. When they were allowed to drink immediately after water was placed in the stomach, they drank an amount of water necessary to make up their deficit—as much as they would have consumed if their stomachs had not just been watered. However, there was a significant development: if the animals were not allowed to drink until fifteen minutes after water was placed in their stomachs, they did not drink at all. In other words, when time was allowed for the body to assimilate the water which had been placed in the stomach, thus making up the deficit in the body's water supply, the animals were not thirsty—

even though the mouth and throat had not been watered (Bellows, 1939).

In a complex series of experiments performed with rats and rabbits it was found that when water was placed directly in the stomach, drinking was largely inhibited—even during the first few minutes after the injection, before there was time for the water to be absorbed. Distention of the stomach by means of a balloon had a similar inhibitory effect on thirst. However, when water was injected into the tissues rather than placed in the stomach, there was still some urge to drink, indicating that the condition of the stomach tissues does play a part in thirst.

In addition to drinking when they were deprived of water for varying periods of time, these animals greatly increased their water intake after having received injections of salt solution or urea (Adolph, Barker, and Hoy, 1954).

Thus the concentration of salt and other chemical substances in the body fluids, as well as the total amount of fluid present in the body, helps determine thirst. This had been indicated in an earlier study performed on dogs.

By injecting the animals with a sugar solution, the experimenters produced a condition of cellular hydration—that is, body fluid surrounding the cells passed through the cell walls into the cell bodies of the organism. Then, when the dogs were deprived of water, the overall water level of the body decreased, but the cells themselves did not become dehydrated as they normally do when there is a deficit of body water. Under such conditions dogs that had been deprived of water refused to drink, even though there was an actual water deficit in the body, and the mouth and throat tissues were very dry (Darrow and Yannet, 1935).

These and other studies indicate that thirst is a complex bodily activity. Much more work is necessary before we can understand all the factors involved.

AIR HUNGER

Probably the most basic requirement of the human body is air, a need that must continually be satisfied. Yet the need for air is relatively unimportant as a motive in everyday life, simply because air is usually easy to get. But when our need for air is not met, air hunger is the most intense of all human drives

and is capable of producing violent activity on the part of the person struggling for oxygen.

The importance of a continual oxygen supply to the body cannot be overemphasized. Although the nervous system consumes oxygen in very small amounts even when at work, this consumption goes on constantly, and severe oxygen deprivation (*anoxia*) for periods as brief as a minute can result in actual neural damage. Temporary asphyxiation at birth (due to failure of the neonate's breathing apparatus to begin functioning when the umbilical cord is severed) may cause serious damage to the nervous system, resulting in feeble-mindedness or other abnormalities.

In one study of over two hundred mentally deficient children, over 70 per cent of the cases were discovered to have suffered severe anoxia at birth. In addition, many of the defective children displayed other symptoms of brain damage such as epileptic seizures and paralysis (Schreiber, 1939).

A history of severe anoxia at birth is almost never found in normal babies.

When oxygen starvation occurs in an atmosphere without excessive carbon dioxide—as on mountaintops or in high-altitude flying—a peculiar sort of drunkenness or confusion results. The person loses control and may shout, fight, or burst into tears. Memory is impaired, the senses function poorly, and paralysis is apt to occur, especially in the legs. Yet the person feels confident of his abilities and fails to realize the seriousness of his condition. There is some evidence that partial oxygen starvation brings out basic emotional reactions usually held under voluntary control.

FATIGUE

We all know how desperate the need for rest can become; yet the physiology of fatigue is so complex that very little is known about it. As a result of prolonged exercise the chemistry of the blood is altered in several ways. One change involves an increased concentration of lactic acid in the muscles. Presumably this condition stimulates the nervous system directly or activates certain receptors. The picture is complicated enormously by the fact that much of our fatigue seems to result not from physical exertion but from frustration, worry, or boredom. Some neurotics, for example, are chronically exhausted, no matter

how little activity and how much rest they have.

Tired people go to great lengths to obtain rest. When fatigue is physically induced, rest brings a readjustment of the body and a cessation of the persisting stimuli which are causing the consciousness of fatigue and impelling the organism to seek rest. When fatigue is emotionally based, rest probably will not bring relief. In such a case the answer more likely will be the resolution of emotional tensions or provision of more interesting activity.

THE NEED FOR SLEEP

Sleep, like rest, is an important need of the body and one which is not yet well understood. It is not even known, for instance, what or how many kinds of sensory receptors (if any) are active when we feel sleepy.

Because certain drugs such as chloroform and ether produce a relaxed condition resembling sleep, it has been suggested that the basis of sleep may be partly chemical. In sleepiness our nerve and brain centers are perhaps directly stimulated by chemical conditions within the body. The muscles are also involved, for one of the outstanding conditions bringing about sleep is a general relaxation of the body.

Whatever the chemical factors in sleep, it is definitely known that sleepiness can be caused by injuries to certain parts of the brain, particularly some of the lower brain centers. Possibly these are the nerve centers controlling the sleep drive.

Besides a variety of physiological theories of sleep, there is also a theory which explains the need for sleep as a learned response. Here certainly is a vital area of human activity which, though familiar to all of us, is barely charted out for future exploration by scientists.

The pattern of behavior by which we satisfy the need for sleep is largely the result of cultural factors. With a few exceptions, such as the Mexicans with their daily "siesta" and a tribe of Bolivian Indians who sleep for short periods regardless of the time of day or night, most cultures have developed sleep patterns that depend upon the regular alternation of light and darkness. But do similar patterns exist among those who must sleep under the midnight sun during part of the year and

spend their waking hours in darkness during the winter season?

A study of the sleep-wakefulness patterns in Tromsø, Norway—the "Capital of the Arctic"—has provided an interesting answer to this question. Though residents of Tromsø may often be seen mowing the lawn or playing a game of tennis around eleven o'clock, there is little street traffic after midnight. The arrival or departure of night boats attracts gay crowds, causing tourists to carry away an impression of a wide-awake town. But this night activity, localized near the piers, dies away completely after the boats have left. In fact, the investigators had to give up their original intention of counting the number of persons crossing the city square late at night because there was no one to count. They obtained their information by interviews instead. At 9:00 P.M. the municipal electricity is cut off in Tromsø and about one fourth of the subjects studied were in bed by that time in winter. But even in summer many went to bed as early as 9:30, and 78 per cent went to bed between 11:00 P.M. and midnight. The mean retiring hour was only about an hour earlier in winter than in summer. Only a few reported using drugs to induce sleep, but those who did so used them more often in winter than in summer. Hours of rising were about the same the year round, but more subjects woke up feeling sleepy and unwilling to get out of bed in winter than in summer. On the whole, then, the sleep-wakefulness pattern in Tromsø was quite similar to that in other communities of the civilized world (Kleitman and Kleitman, 1953).

Though sleep is essential for recovery from fatigue, studies have shown that it is possible to go without sleep for as long as one hundred hours with only slight losses in efficiency in the performance of relatively short tasks. In complex tasks requiring considerable alertness, however, performance declines significantly during the course of fifty hours without sleep (Clark *et al.*, 1946).

A recent study demonstrated that subjects deprived of sleep for thirty hours did not perform as well as control subjects on a complex mental task.

The apparatus consisted of twenty small cards attached to a rotating loop of film. The subject was to compare each of the moving cards with each of ten stationary ones in order to determine the number of differences between the two sets. Each card was marked with six symbols, regularly located. One of

two symbols appeared in a given location on each card—that is, in the upper left corner would be either an X or an O, in the upper right corner either a / or a V, etc. Thus in each comparison there might be as many as six differences between the cards.

One decision every six seconds for twenty-five minutes was required. All subjects performed the test on the morning of the same day. The six experimental subjects were allowed to do anything they wished except sleep for the next twenty-four hours. At this time the test was administered again. A third session was held six hours later. The results showed that the performance of the experimental subjects declined slightly, while that of the controls (who presumably had a normal night's sleep) improved considerably during the experiment (Chiles, 1956).

Though individual needs vary, most people require from six to nine hours of sleep daily. That the traditional eight hours of sleep is probably based on bodily needs was indicated recently by the experience of the British North Greenland Expedition (*Science News Letter*, 1956). Throughout the perpetual night of the arctic winter, members of the expedition were allowed to sleep as much as they liked at whatever hours they chose. Although it seemed as if they were sleeping excessively, when actual hours of sleep were totaled up it was found that the members had averaged 7.9 hours a day.

HEAT AND COLD AS DRIVES

Everyone everywhere is affected by the weather. Clothes, houses, sports, agriculture—and sometimes, it is said, even temperament—are affected by how hot or cold the climate is. No one can dispute the importance of warmth and cold as drives. But just what is their physiological origin?

First of all, the senses of warmth and cold are mediated by distinctly separate sensory receptors. Some receptors in the skin are sensitive to contact with warm objects and others are sensitive to cold. As in the case of the other drives, the hypothalamus, which responds directly to the temperature of the blood flowing through it, plays a vital part in the adjustment of the body to heat and cold.

The temperature of the human body is regulated by a complex mechanism that balances heat loss against heat production. Thus two temperatures are always involved: the amount of heat in the surrounding environ-

ment and the heat produced by the body itself. Our bodies obviously can lose less heat to their surroundings on hot, humid days than they can on cold days.

When we feel cold—that is, when the external temperature falls below about 57 degrees—bodily activity is stimulated. Increased secretion of thyroxin and adrenaline helps bring about this increased activity. Increased muscular activity takes place; the blood pressure rises. Blood is driven from the surface of the body to the deeper tissues, where it will not be exposed to the cold. The reaction to heat is largely the opposite. When external temperature is raised, bodily activity slows down. Perspiration helps cool the body surfaces. The arteries at the surfaces of the body dilate, thus exposing a greater volume of blood to the outer surfaces of the body for cooling. The circulation rate is increased to put more blood through this “cooling system.”

All these automatic changes act in various ways to keep the temperature of the body tissues at a fairly constant 98-99 degrees Fahrenheit, regardless of the temperature of the environment. But besides these continuous, automatic adjustments to warmth and cold, there are many things we deliberately do to keep our bodies at a comfortable temperature. Electric fans, air conditioners, ice water, lightweight suits and oil burners, hot drinks, fur coats—all are familiar results of man's drives to adjust to warmth and cold. And all indicate the importance and social ramifications of these drives.

THE SEXUAL DRIVE

The sexual drive is second only to the hunger drive in its implications for social living. While our society does not place many elaborate restrictions or taboos upon the food-taking behavior of its members, sexual expression is very closely governed both by law and by firmly rooted social conventions. Because our social structure limits an individual's sexual behavior, conscious awareness of the sex urge is more persistent and more insistent than hunger and other drives which are not so likely to go unsatisfied. This socially necessary conflict between the sexual drive and the cultural restrictions on its expression makes sex one of the most powerful dynamic forces in human behavior. Although sexual activity is necessary to the survival of the race,

it is not actually essential to keeping an individual alive. Most modern physicians and psychologists believe, however, that sexual satisfaction is conducive to the best physical and mental health.

Scientists are still trying to find the exact location of the internal controls in the sexual drive. They do know with certainty that the intensity of the sexual urge is dependent upon the chemical condition of the blood. Observations of both animals and human beings show that the strength of the sexual drive is profoundly influenced by the presence or absence of certain internal secretions, the most important of which are produced by certain cells in the reproductive organs (the ovaries of the female and the testes of the male).

The sexual drive in the male. As you will recall from our earlier discussion of the endocrine glands (Chapter 2), the sexual development of the male is steered by (1) the *androgens*, which are hormones secreted by the testes, and (2) certain “middle man” hormones secreted from the pituitary body.

In the normal male the supply of androgens appears to be relatively constant, or at least fails to show the monthly periodic cycle characteristic of women. Adult men who are castrated through accident or disease retain for years their ability to perform the sexual act, although there is usually some decline in the strength of the sexual drive. The “middle man” hormones affect the sexual function both by acting directly on the testes (and thus influencing the supply of androgens) and by stimulating the adrenal cortex, which in turn secretes a hormone that accelerates sexual maturation in the male. Here again we see the overlapping functions in the endocrine system.

In normal development these various forces seem to operate at a relatively constant level, so that the sexual drive of the male remains fairly stable. It is, of course, subject to some fluctuation as a result of general physiological conditions such as fatigue and also may be increased or lessened as a result of various psychological factors. This latter is especially true in the case of human beings.

Among men the peak of the sexual urge comes in the late teens and begins to decline at about the time the average middle-class male commences to consider marriage, i.e., in the early twenties (Kinsey, Pomeroy, and Martin, 1948). The falling off of the sexual

urge is largely caused by a decline in the quantity of androgens secreted, but it can also be influenced by such social factors as tiring of a particular sexual partner or becoming preoccupied with social, family, and economic interests.

The sexual drive in the female. The sexual drive of the female is much more complex than that of the male. It is not surprising, therefore, that the glandular and social basis of the sexual drive in the female is also much more complex. The primary sex tissues of the female are the ovaries. These are responsible for the secretion of the principal female sex hormones: the *estrogens*, which influence the sexual urge, and *progesterone*, which is important in pregnancy.

Estrogen secretion into the bloodstream increases each month just before and after *ovulation*, when a mature egg cell is released from the ovary and slowly makes its way down the *oviduct* ("egg conductor"), a tube leading from the ovary to the uterus. The brief time when the egg is in the oviduct or the uterus is the only time a woman can become pregnant, and it lasts only a few days during the month. In the adult female, ovulation usually occurs about halfway between the two menstrual periods:

It is definitely known that the female sex urge is influenced by the estrogens. This relationship is most clearly noticed in the lower mammals. At ovulation, when the bloodstream becomes enriched with estrogens, the female animal loses her previous indifference to the male and becomes highly receptive or even aggressively suggestive in her sexual behavior. This behavior is known as estrus, or "heat," and is a signal that the female animal is in a condition of readiness for pregnancy.

Social factors are even more important in regulating the sexual drive of women than of men. Among married women questioned by two psychologists only 38 per cent reported that their sexual adjustment was adequate. Twenty-three per cent regarded sex as a duty, neither pleasant nor unpleasant, and 7 per cent said that they never had experienced a sexual climax and that certain phases of the sexual act were repulsive to them. The rest of the subjects had what the psychologists called fair adjustment—they regarded sex as being pleasant but seldom achieved a sexual climax (Landis *et al.*, 1940). A similar state of affairs does not seem to exist among other

healthy mammals and in the case of human beings may largely be attributed to social factors. A careful study of six thousand marital histories and three thousand divorce histories has supported the conclusion that in our culture social as well as biological factors contribute to sexual maladjustment (Kinsey *et al.*, 1953).

The most common cause of sexual maladjustment seems to be inadequate—or inaccurate—sex education. Girls especially are taught prudish attitudes toward sex and often come to feel that the sexual drive should always be denied. Because their prejudice against sex has become so ingrained, many women find it difficult to participate freely in sexual relations after marriage and so appear to their husbands as frigid and uninterested. This situation is aggravated by the fact that many men do not understand that part of their marital obligation is to consider the wife's feelings; often they approach the sexual act in an abrupt manner that is frightening or distasteful to their partner. Unpleasant sexual experiences as well as fear of sex can make a woman psychologically frigid, even though she may be perfectly healthy biologically.

PAIN AS A DRIVE

To serve most effectively as a motive, pain must be prolonged. If you touch a hot iron accidentally, you draw back your hand. This is a simple, specific, previously organized response—the *withdrawal reflex*. Localized pain of brief duration is not, properly speaking, a drive. But suppose that even after you have withdrawn your hand the burn continues to smart and you go to the doctor to get it dressed. Here pain is serving as a drive.

Pain has an important biological significance in that most harmful situations produce pain as well as injury. Therefore, in seeking to avoid pain we also tend to avoid being hurt. The desire to avoid pain and to protect others from it has been one of the important motivating forces in the history of mankind. A good example of its effects is the search for better anesthetics.

Contrary to popular thinking, pain and pressure are separate sensory experiences. Each has its own specific neural mechanisms. Even in the laboratory, however, it is hard to separate the two qualities of experience. If you stick yourself with a needle or cut yourself

with a knife, you feel both pressure and pain. As a matter of fact, if you think back carefully to the last time you pricked yourself with a needle you will recall that you felt *two* kinds of pain—a “bright” flash of pain followed by a “dull” ache.

Histologists—scientists who slice tissues into thin layers and study them under powerful microscopes—have found that there are two kinds of pain fibers, one for each kind of pain (Gasser, 1943; Tower, 1943). Further evidence for the existence of two types of pain is seen in the well-known medical fact that cocaine blocks the slow-acting, dull-pain nerve fibers first; whereas asphyxia, or oxygen starvation, acts first on the other type.

To a greater extent than some of the other biological drives, pain is closely related to the general emotional setting in which it occurs. Most neurotics react more vigorously to pain—and react to weaker pain stimuli—than do well-adjusted individuals. Mentally ill persons who have lost touch with reality, on the other hand, respond to pain stimuli far *less* than do normal persons (Hall, 1953).

BOWEL AND BLADDER TENSIONS

When the bladder and lower colon become distended, receptor cells in their walls are stimulated and produce drives. These drives usually have little significance as motives, since obstacles to their relief are seldom imposed, but they have the characteristics of the other biological drives: (1) they may be defined as the conditions associated with some bodily need; (2) they grow out of the physiological state of the tissues; (3) they stimulate sensory receptors and thus set up activity in the nervous system and brain; (4) they produce by this stimulation a restless activity which continues until the tissue needs have been met.

PSYCHOLOGICAL AND SOCIAL DRIVES

Biological drives have a direct physiological basis. They are fundamental. But obviously there are many other forms of human motivation. What is the relationship between

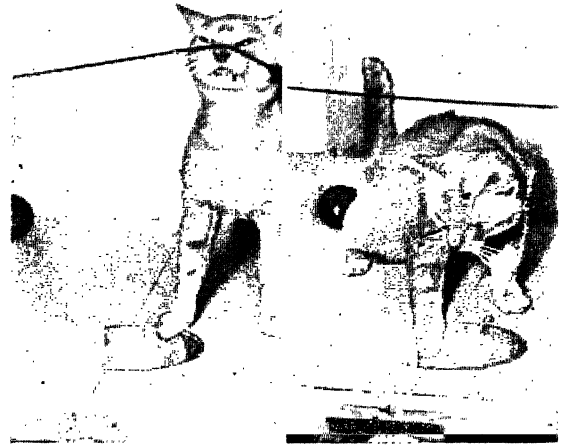
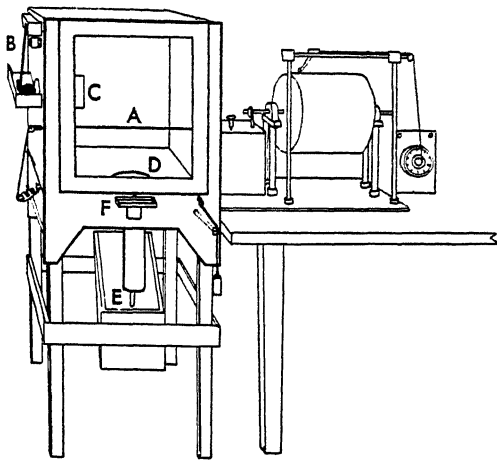
physiological needs and such motives of man as his curiosity about the world, his political and religious beliefs, his capacity to hate and to love, his patriotism, and his ambitions to make money and gain prestige? In many ways these complex psychological and social drives are more important to man than his biological drives, for they are more closely tied up with his relations to other people and thus with his happiness in life.

ORIGIN OF PSYCHOLOGICAL AND SOCIAL DRIVES

What causes one man to *seek* approval, another to *expect* it? Why is social approval defined in terms of financial success by one, in terms of intellectual ability by another, and in terms of membership in clubs and associations by still another? Do these motives grow from bodily needs? Are they learned in some way from the environment? These questions are tremendously complex, and psychology has only begun to find answers.

Learned rewards. The process by which previously neutral objects can come to act as incentives is essentially a matter of learning. A common example of this process is the way in which words can come to take the place of actions in training a dog. By being petted at the same time he is praised and by being whipped while being scolded, a dog comes to react to kind or harsh words in the same way he originally acted to the petting and the physical punishment. Words have become symbolic—through learning they have come to represent feelings, objects, or situations not immediately present.

In one series of experiments demonstrating learned rewards chimpanzees were trained to attach value to poker chips which they received in “payment” for performing various tasks. The animals were taught to insert the tokens into vending machines which yielded some primary reward like a grape or raisin for each token inserted. Once the reward value of the tokens had been learned, the chimpanzees were taught a series of complicated tasks which rewarded them with a food token for each correct response. The fact that the animals readily learned these tasks demonstrated the reward value they attached to the poker chips as a result of previously associating the tokens with the primary reward of food (Wolfe, 1936; Cowles, 1937).



The drawing above shows the apparatus used with cats learning to work for token awards. First the cat presses string A, which releases balls from container B. The balls fall into the box through the opening C, and the cat must roll them into the funnel at D. After falling through the funnel the balls strike the switch E, which opens the door of the box so that the cat can get the salmon located in the pan F. The cat above at left is pressing the string with his head in order to get a ball; at right he is "spending" the ball in order to open the glass door leading to the salmon.

Humans also learn to attach reward values to formerly neutral objects. As we have seen, babies learn to react to voices and eventually to words as representing or suggesting the satisfaction of their bodily needs. All through infancy the child hears his mother's voice murmuring affectionately as she responds to his crying and relieves him of pain, wetness, hunger, and thirst, or gives him the pleasurable sensations of fondling and caressing. "In the first year of its life," it has been pointed out, "the human infant has the cues from its mother associated with the primary reward of feeding on more than 2000 occasions" (Dollard and Miller, 1950). As the child grows older and starts to play with other children, it sometimes happens that he is hurt by some plaything or is bullied by an older child. Here again the mother sets things right, at the same time speaking words of love and sympathy.

Under these and similar conditions the mother's voice gradually comes to take on the same sort of reward value as purely physiological relief. That is, words and objects which cannot themselves satisfy biological drives and are not originally sought for their own sakes come to be associated with real rewards, until they eventually acquire a reward value of their own. Rewards of this kind are often called *symbolic rewards*. They are sought by all socialized human beings.

Slowly at first, then more rapidly as he

becomes increasingly aware of other people, the child acquires a growing store of effective symbols. Certain objects, sounds, and reactions of others become associated—with varying degrees of remoteness—with the satisfaction of his basic needs and eventually come to be sought for themselves. Through a similar learning process the organism can be motivated to *avoid* words and objects which have come to be associated with some painful experience. Studies with animals have demonstrated clearly the motivational nature of acquired fear (Miller, 1948). In the following chapter on emotions we shall examine in detail the manner in which fears can be learned.

The fact that symbolic rewards and punishment can influence behavior even when the subject is unaware of why he is being rewarded or punished has been brought out in a recent experiment.

The subjects, seventy-five college students, were divided into four experimental groups and one control group. Each subject was asked to say all the words he could think of during a fifty-minute test period. He was not allowed to use phrases or sentences or to count. The subjects in each group were tested individually, and each session was tape recorded.

In testing the subjects in Group 1 the experimenter said "mmm-hmm" after each plural noun spoken. In testing those in Group 2 he said "huh-uh" after

each plural noun. In Group 3 he said "mmm-hmm" after all responses that were *not* plural nouns. And in Group 4 all nonplural responses elicited "huh-uh." This procedure was followed only during the first twenty-five minutes of the experiment. In the control group the experimenter did not say anything in response to any of the words used by the subjects.

At the close of the session each subject was asked what he thought the experiment was all about, what the "mmm-hmm's" or "huh-uh's" meant. If he had "caught on" to the relationship between the experimenter's response and his own use of plural or nonplural words, the subject was eliminated from the experiment. Only ten subjects were thus eliminated.

Analysis of the results from the remaining sixty-five subjects indicated that "mmm-hmm" increased the number of plural responses during the time it was used and for the first five minutes after it was omitted. The use of "huh-uh," on the other hand, decreased the number of plural responses significantly (Greenspoon, 1955).

This is an experimental illustration of unconscious motivation. In later chapters on frustration and stress we shall discuss many more examples of how our behavior can be directed by motives of which we are not even aware.

Are there innate psychological needs? The theory of learned rewards only partially explains the development of psychological and social motivation. Man everywhere seems to have certain basic psychological needs which he expresses through the social patterns of his particular culture. Among these are the need for security, the need to respond to others through the exchange of love and esteem, the need for new experience and greater knowledge, and the need for approval and some degree of prestige. Although these needs are sometimes overwhelmed by other needs and by obstacles in the environment, their satisfaction is nonetheless essential to an individual's healthy development. Psychologists have learned that frustration of man's psychological and social drives—while it does not lead directly to death as does prolonged frustration of most biological drives—can eventually result in emotional disturbances or even in physical illness. In speaking of motivation as physiological or psychological, therefore, we must always remember that there is no strict separation between these categories.

The importance of certain psychological needs to the individual's health as well as his

happiness—together with the fact that such needs are found in people of widely different cultures—has led some psychologists and anthropologists to speculate that some psychological drives are inborn rather than acquired. Research has been far from sufficient, however, to establish such a theory. At the present time most psychologists regard man's social and psychological needs as the product of his past experience—although recent studies with animals (pages 141-142 and 535-538) give evidence for inborn psychological needs.

SOCIAL FACTORS IN MOTIVATION

Man's psychological and social drives—whether or not they have some innate basis—are relatively unstructured. Their expression is fostered and shaped by many factors. Although certain basic needs (such as the need for security and for social approval) seem always to be present, the manner in which they are satisfied depends upon the individual's environment and his particular stage of physical, social, and emotional development. An individual's motivational pattern becomes increasingly complex as his experience widens. The adult has many motives as a spouse, parent, or wage earner, for example, that never occurred to him as a child.

The need for social approval. Even in infancy a child learns that parental approval goes with certain kinds of behavior and that disapproval goes with others. He finds that when he does the right thing he receives the satisfactions—if only in words—that go with approval; when he does wrong, he receives disapproval and may be punished. He comes to think of things as "good" or "bad" according to his parents' reactions, and his behavior comes to be motivated by a desire to conform to their standards.

The very words used by parents in different cultures tend to foster different values. When the American mother would say, "Be good!" the French mother says, "Be wise," the German says in effect, "Get back into line!" the Scandinavian says, "Be friendly," and the Hopi Indian says, "No, that is not the Hopi way" (Sinclair, 1954). Thus the child learns to judge his behavior primarily in terms of whether or not it is prudent, whether or not it is considerate and helpful, or whether or not it conforms to society's demands. The



Social Motives in Another Culture

Two social anthropologists, Joseph Weckler and Conrad Bentzen, studied the people of Mokil, an isolated atoll with an area of less than one-half square mile and a population of 425, located in the Caroline Islands of Micronesia. The Mokilese live in intimate contact with each other and with nature. Their culture teaches them early in life to work and play in cooperating groups and not to expect or want privacy.

On Mokil, as elsewhere, adult-child relationships are basic to the child's formation of attitudes. The suckling babe is fondled and indulged; parents, other adults and children of the joint family, and even visiting friends, hold him on their laps and carry him astride their hips. There is no set bedtime, and he is given the breast whenever he indicates hunger or cries. Even if his mother is busy at some task, he may crawl into her lap and nurse without reproof.

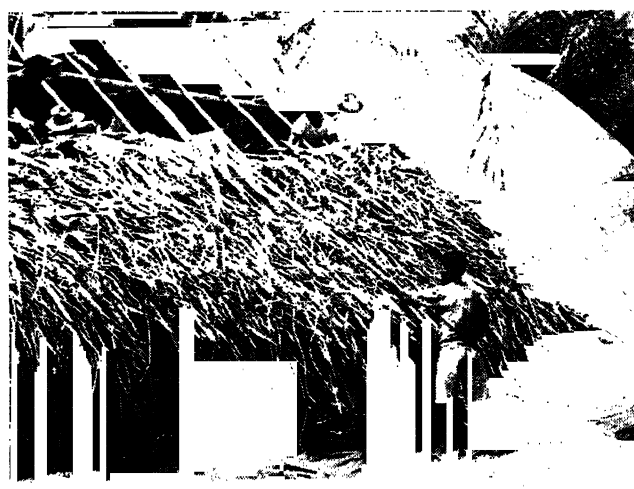
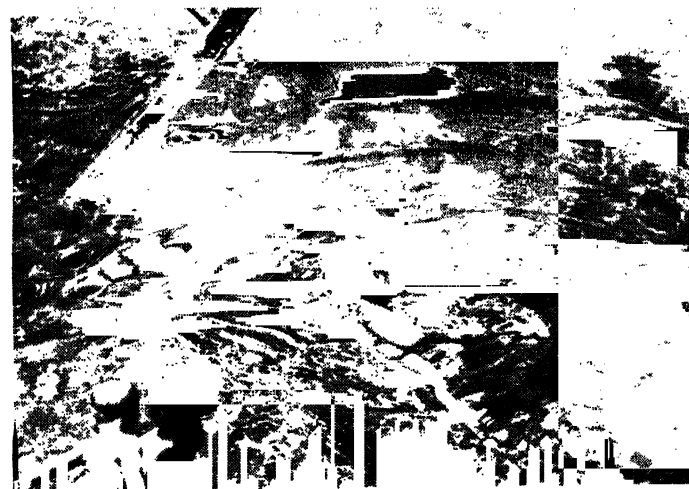
When the child is about three, however, the mother suddenly ceases her complete indulgence, forcibly weans him, and turns him over to the care of



older children for much of the day. The common result is temper tantrums. The mother's response is to slap the child, to throw rocks at him, or even to toss him into the lagoon. The child is thus forced to learn to spend most of his time with other children.

Older children cheerfully take younger siblings wherever they go. Consequently many babies, without instruction, learn to swim before they learn to walk. Children learn group cooperation and the virtue of sharing from the example of their older playmates. If a child obtains some delicacy he invariably shares it with his friends.

The emphasis on group cooperation and sharing persists throughout life. It is essential in many tasks like reroofing a canoe house. Every family donates thatch "shingles" and the labor of one or more men so that another family's roof can be recovered quickly. Marked preference for group activity is shown even when it affords no economic advantages. Women weaving mats for household use or for sale take their materials to a common place where several women can work together in preference to working at home alone.



difference, of course, is one of emphasis, since all these standards may be used in evaluating behavior.

The mother's or father's words and tones often check the child from doing things he very much wants to do. But the words and tones of approval may also be connected sometimes with things that he does *not* want to do, like setting the table or clearing the sidewalks of snow. It usually happens, therefore, that the individual begins to experience some degree of conflict over this matter of approval and disapproval—that is, he is not sure whether he most wants his own way or his parents' approval. In some persons this conflict may result in *negativism*—it is as though the child has learned to want the things forbidden and to be averse to the things for which he is given praise. Unwise parents sometimes destroy much of their child's tendency to seek social approval by demanding too often that he sacrifice his own inclinations.

At first, symbols of social approval are important to the child only when they come from his parents, his nurse, or anyone close to him who satisfies his needs. Gradually, however, he comes to desire the approval of society as a whole—or at least of the particular social group to which he belongs. The stock of symbolic ideas, words, and objects that motivate his behavior grows to include the many symbols that abound in social life: flag, slogans, principles of political or social reform, philosophic ideas. Each culture supplies its own stock of these symbols, which can greatly influence the individual's pattern of motivation.

Among the Arapesh, a primitive tribe living in the mountains of New Guinea, infants are cherished and protected and are gently fed whenever they are willing to eat, even though they show no signs of hunger. Throughout childhood an attitude of passive acceptance of food and other requirements is fostered. As a result the mature Arapesh are a gentle, cooperative people, chiefly interested in growing things, and seldom showing aggressive behavior, even though life is difficult and food hard to obtain in their rocky mountain environment.

In contrast, the Mundugumor, a neighboring tribe, carry their infants in harsh baskets that scratch their skins and nurse them only until they are barely satisfied, causing them to suck aggressively and to develop a basically angry attitude toward life. Formerly headhunters, the men of this tribe spend

most of their time preying on their neighbors. The women are almost as aggressive and tend to dislike the role of mothers. They provide most of the food supply, leaving the men free to fight (Mead, 1955).

Adjustment to social requirements is a vastly different thing among the Mundugumor than it is among the Arapesh, and vastly different social motives are acquired in early life. In either case, however, social needs for security and approval must be satisfied as well as the biological drives.

Values as motives. Psychologists maintain that human motives can be classified according to the importance they have in our lives—that is, according to their *value* to us. If a goal seems well worth attaining, we say that it has a high degree of value and that working toward it is good. When it seems scarcely worth attaining, we say that its value is small. If it is something to be avoided, we say that it has a negative value.

Everyone is motivated by a system of values, determined largely by his home environment. For example, a child who grows up in a home where moneymaking is valued above all else will probably accept the material values of his parents, whose love and respect he seeks. On the other hand, a child who comes from a family that admires self-sacrifice and public service will probably be motivated by *those* values.

Of course, there are children who become alienated from their parents and home, for one reason or another, and who seek the approval and adopt the values of persons outside the home. An adolescent who has rebelled all his life against his parents will probably want to belong in a group outside the home and will accept that group's interests and values as his own. This does not contradict the fact that our values are developed by a process of learning from others with whom we associate. The home, school, church, movies, trade unions, clubs, and many other social institutions are the great teachers of human values. They interact with prevailing patterns of behavior to make a people's way of life.

An individual who disagrees with the behavior and values prevalent in his society will seek social approval as much as anyone—but the important "society" for him is a small group whose private code of values runs counter to the prevailing one. The fact that some people break away from accepted social standards can be a force for evil or for good.

When dissenting subgroups try to force change by violence and intimidation, society suffers. When dissenting behavior is orderly, on the other hand, it often produces needed reforms which benefit society as a whole. A serious problem today is the apathy of people who are privately critical of political or social conditions but at the same time are completely cynical about the possibility for change in these areas.

Interests as motives. For most people, interests serve as important motives. The term *interest* is usually employed by psychologists to mean a pleasurable feeling that accompanies some activity in progress. In everyday words, a person has an interest in something he likes to do—whether it is stamp collecting, fishing, writing, or working.

Social learning is very important in determining our interests as well as our values. For the most part we become interested in the things we can do well and for which we receive some degree of social approval. If an individual has artistic ability, for example, artistic pursuits will probably *interest* him as a hobby or vocation. His successful achievements in this area increase his feelings of personal adequacy and win him a certain amount of admiration from others. In varying degrees the successful sportsman or student or businessman finds similar satisfactions in pursuing his particular interests. On the other hand, an individual seldom becomes seriously interested in an activity at which he repeatedly fails or of which society disapproves. The development of individual interests—and the degree to which these interests motivate behavior—is directly related to our need for self-enhancement.

CURIOSITY AS A DRIVE

A human motive which is particularly important in causing us to acquire knowledge is *curiosity*. A careful search of the published literature has indicated that psychologists somehow neglected to study curiosity for a period of over forty years (Dennis, 1955). Recently, however, investigations have been resumed. The evidence thus far seems to indicate that a tendency toward investigation is inborn or learned without formal training.

As early as 1881 it was observed that monkeys would tirelessly investigate their surroundings and actively manipulate any new object, although no

reward was to be gained except the sheer fun of it. One monkey worked for two hours (unsuccessfully) trying to open the lock of a trunk in which nuts were stored, although a plentiful supply of nuts was within easy reach (Romanes, 1882).

Thorndike reported in 1901 the case of a monkey who repeatedly struck a projecting wire to make it vibrate. Thorndike stated, "He did not, could not, eat, make love to or get preliminary practice for the serious battles of life out of that sound. But it did give him mental food, mental exercise. Monkeys seem to enjoy strange places; they . . . like to have feelings as they do to make movements. The fact of mental life is to them its own reward" (Thorndike, 1901).

This interest in investigation and manipulation has recently been studied systematically by Harlow and others.

Monkeys learned to discriminate between two colors of screw eyes with no reward for correct performance except the satisfaction gained from manipulating the apparatus. A test board was presented to them, in which a number of screw eyes had been placed. The red eyes could be removed, but the green ones could not. The problem consisted of learning to remove all of the red eyes without



In another study by Harlow, in which monkeys learned to unhook hasps, the satisfaction obtained from manipulation of the apparatus was the only reward.

touching the green ones. In this and six other problems involving different paired colors of screw eyes the monkeys showed progressive improvement, with no decrease in their motivation throughout the study. Rest periods prevented satiation or boredom with the problem, but manipulation was the only reward used. Such rewards as food were unnecessary to stimulate learning (Harlow and McClearn, 1954). Indeed, food rewards may actually disrupt the learning situation, as shown in an earlier study (Harlow, Harlow, and Meyer, 1950).

Our motive to investigate—our curiosity—may occasionally lead us into trouble and is often discouraged in children because it inconveniences their parents. But curiosity does far more than kill cats. It is a valuable motive force which, when properly guided and channeled, has led to the advancement of mankind.

PSYCHOLOGICAL AND SOCIAL MOTIVES IN HOMEOSTASIS

At the beginning of this chapter we saw how the biological drives act as homeostatic mechanisms. That is, when physiological equilibrium is disturbed by the need for food, water, sleep, etc., the organism experiences internal tensions which propel it into seeking-activity designed to satisfy the need and thus to restore equilibrium. We have also seen how human beings—anticipating that their biological needs will keep recurring—have developed elaborate ways to hold the physical environment constant, thereby simplifying the task of satisfying their needs.

Man's psychological and social motives operate as homeostatic mechanisms in much the same fashion, motivating the individual to create and maintain a social environment in which he can satisfy his needs for love, for security, for approval, for prestige, for experience, for knowledge. His self-concept—that is, his picture of himself and of his relationship to his environment—acts as another "constant state" which the organism seeks to preserve, much as it seeks to preserve the various tissue constancies (Stagner, 1951). Indeed, since the adult human organism can usually satisfy its biological needs with relative ease in modern society, the primary motivating force behind human behavior often seems to be that of satisfying psychological needs. To do this the organism must maintain equilibrium in its physical and social

environment as well as in its own physiological condition. Homeostasis in human life thus becomes a very complicated process.

Social equilibrium is necessarily dynamic rather than static, since both the individual and his environment are always in a state of change. In order to maintain equilibrium on the social level, man must continuously reorganize his environment in ever more complex ways. Sometimes the reorganization is consciously planned, as when people work for improvements in their jobs or in their communities or in international relations. But psychological needs are not generally as well understood as biological ones, so that environmental conditions and relationships often spring up without design. In many cases, therefore, the individual must satisfy his psychological needs by "adjusting" to his present environment in the best way possible, rather than by attempting to reshape it. Thus a person will select the profession, neighborhood, social group, and the like through which his self-concept can best be maintained and enhanced.

Fortunately, most of us find that our surroundings provide enough personal security and freedom from physical want so that we can use the resources of our environment to develop the various potentialities of our personalities. This "self-actualization" is the most complex form of homeostasis and involves far more than the mere reduction of tensions which characterizes homeostasis at the physiological level (Allport, 1953). The "preferred patterns" of behavior developed by the individual in self-actualization actually create many new tensions, as the pattern of equilibrium becomes increasingly complex. Rather than seeking merely to escape these tensions, however, the mature adult strives to reduce them by channeling them toward new and more worth-while goals.

S U M M A R Y

With the exception of simple reflex activity, all human behavior is *motivated*—that is, directed toward the achievement of some *goal* (reward or incentive) which will satisfy a particular *need*. The motives, or stimulus conditions, that direct our behavior may be

classified as (1) *biological drives* and (2) *psychological and social drives*. The term *drive* refers to any condition of the organism which creates internal tensions and thus impels it to activity.

The *biological drives* are *inborn*. They arise out of inherited structures and are present in all peoples of all races as well as in the lower animals. The essential characteristics of the biological drives are: (1) they are associated with some bodily need; (2) they grow out of the physiological state of bodily tissues—and thus are often referred to as resulting from *tissue needs*; (3) they stimulate sensory receptors and thus set up activity in the nervous system and brain; and (4) they produce by this stimulation a restless activity that continues until the tissue needs have been satisfied. The biological drives operate as regulatory mechanisms which automatically help the organism maintain a constant internal environment. This is the most basic aspect of *homeostasis*. Homeostasis in human life also involves an attempt to hold the physical environment relatively constant, so that recurring tissue needs can be met more surely and with less effort.

Prolonged failure to satisfy the biological drives can result in personality change, impaired health, disease, or even death. The *intensity* of the various drives seems to be related inversely to the length of time we can stand deprivation of them. *Air hunger* is the most intense, followed by thirst and then *hunger for food*. Other biological drives are associated with *fatigue, sleep, heat and cold, sex, pain, and bowel and bladder tensions*. The physiological mechanisms by which these drives operate are only partly understood, although recent evidence indicates that most of them are "cleared" through the *hypothalamus*. The drives of hunger, thirst, and sex have been studied more thoroughly than the others.

Although the biological drives are inborn, the manner in which an individual satisfies his tissue needs is greatly influenced by *learning* and *cultural* factors. In efforts to satisfy the hunger drive, for example, people have developed elaborate systems of agriculture, food storage, and commodity exchange as well as customary ways of preparing and

eating food. They have also acquired *specific hungers* for certain foods.

Next to the hunger drive, the sexual drive probably has the greatest implications for social living, largely because sexual expression is so closely governed by both law and custom. Psychological factors play a particularly important role in determining the effectiveness of sexual adjustment.

Many of the most important human motives derive from *psychological and social drives*. Among the most important of these are the need for security, the need to respond to others through the exchange of love and esteem, the need for approval and some degree of prestige, and the need for new experience. Although these needs are met in very different ways in various cultures, their satisfaction is essential to the individual's health as well as his happiness.

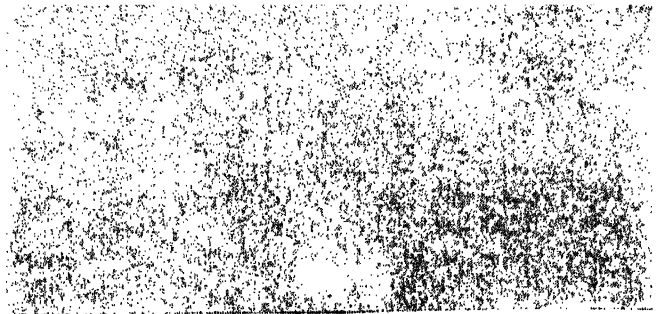
Psychologists have not determined the exact origin of even our most basic psychological and social drives, but the evidence to date indicates that most of them are probably *acquired* as the result of past experience. To a large extent they result from a learning process in which *symbolic rewards*—or punishments—become increasingly important in directing behavior. We may be motivated by acquired *fears* and the desire to *avoid* certain experiences as well as by the desire to achieve rewards and incentives. Often our behavior is directed by learned motives of which we are not even aware.

The importance of learning and social factors in motivation is clearly shown by the different manner in which people of various cultures express their need for social approval. Social learning also determines the development of individual *interests* and *values*, important motives in everyday life. Evidence indicates that the motive of *curiosity*, on the other hand, is independent of learning.

Man's psychological and social motives operate as homeostatic mechanisms by motivating the individual to create and maintain an environment in which his personality needs—as well as his biological needs—can be satisfied. Homeostasis in human life thus becomes a highly complex process whereby man not only maintains biological equilibrium, but also stabilizes his physical and social environment.

CHAPTER SIX

EMOTIONS



WHAT ARE EMOTIONS?

PHYSICAL RESPONSES IN EMOTION

EMOTIONS AND HEALTH

HOW EMOTIONS DEVELOP

When the mind is upset . . . we see all the spirit in every limb upset in sympathy. Sweat and pallor break out all over the body. Speech grows inarticulate; the voice fails; the eyes swim; the limbs totter; the ears buzz. Often we see men actually drop down because of the terror that has gripped their minds." This vivid description, written by the Roman poet Lucretius (B.C. 96?-55?), shows that emotion was just as important in ancient times as it is today, and just as fascinating to students of human nature. Through the ages some philosophers have sought to overcome their emotions and live in a calm, rarefied atmosphere of pure intellect. But most of us would find such a life intolerable, for the emotions lend color and variety and meaning to existence. We even supplement our own emotional life by seeking vicarious emotions—and not always pleasant ones. No doubt you have often heard people remark how much they enjoyed a movie or a book because "it was so sad."

WHAT ARE EMOTIONS?

The problem of defining the emotions precisely is a very difficult one. There is no clear-cut distinction between emotional and nonemotional behavior, nor are there any sharp lines of demarcation between one emotion and another, for the human emotions blend into one another like the colors of the spectrum. Moreover, the basic emotions—delight, love, fear, anger, and the like—often combine in various and unknown degrees to produce complex emotional patterns such as romantic love, patriotism, zeal, awe, and contempt. Even pleasant and unpleasant emotions are often mixed. The man who is promoted to a better job in a different city, for example, may be torn between pride in his achievement and regret over leaving his home and friends.

The second major problem in trying to define emotion is the generalized nature of an emotional response, which literally involves the entire organism. It is difficult, if not impossible, to observe and measure all the

physiological and psychological changes that make up an emotional response.

Emotion is perhaps the most complex of all the dynamic processes underlying human behavior. To simplify our study, we can think of an emotional response as having three main aspects. (1) Most of us think of emotion, first of all, as *conscious experience*—as the feeling of being happy, angry, excited, afraid. These conscious feelings of emotion seem of paramount importance in our personal and social adjustment. (2) An even more significant component of emotion is the organism's *physical response* to emotion-provoking stimuli. Any strong emotion, such as fear or rage, is accompanied by a vast complex of internal changes involving muscular, chemical, glandular, and neural activities throughout the body. An emotional response also involves changes in facial expression and in overt behavior. The physiological aspects of emotion are what distinguish it most clearly from other psychological processes. (3) Finally, we must

think of emotions as *motives* that affect an individual's behavior toward the objects and people in his environment.

EMOTIONS

AS CONSCIOUS EXPERIENCES

Although we cannot observe a person's feelings directly but rather must infer them from his overt behavior and from his verbal report, no one can doubt the reality of emotion as conscious experience. When we act angry in an exasperating situation, we also *feel* angry.

The conscious aspects of emotional experience are sometimes unpleasant, and they sometimes lead us to destructive and anti-social behavior. But there is great social as well as personal value in many kinds of emotional experience. Without mother love, children would not adequately be cared for and educated. If we did not take pleasure in work of some kind, the physical means of subsistence would be neglected. If we did not experience esthetic pleasure, art would die. If we did not receive satisfaction from gaining knowledge, science would not exist. If people were incapable of emotion they would not experience loyalty, patriotism, or intense interest in social reform. Religion, if it continued to attract people at all, would become academic.

Introspective description of emotion. Although the conscious aspects of emotional experience defy objective observation, we can obtain valuable information about the nature of a person's emotional life from his subjective report of his own feelings. The method of introspection has thus been employed extensively by psychologists to identify and analyze the basic components of emotional experience—the internal bodily sensations felt and their intensity and localization, as well as the other conscious elements.

Introspection has its limitations, of course, and information obtained by this method must be interpreted with caution. When a sensation takes place within us, we can never be quite certain that it is exactly the same as the sensation felt by another person. Two people may each report that they have a quivering sensation in the "pit of the stomach," but we cannot be entirely sure that they are having the same inner experience. Moreover, if the introspections of different individuals are to be compared directly, they must be reported

in exactly the same language. This is a difficult requirement, for it is hard to give specific names to subjective phenomena. There would not be words enough to describe all conscious emotional experiences even if they could be clearly separated.

Everyday emotional experience. Man's emotional repertoire is exceedingly large and varied, ranging through anger, fear, elation, delight, affection, annoyance, worry, jealousy, dejection, and shame. All these emotions—and others—play vital parts in our lives. In terms of the frequency with which we experience them, however, the strong emotions such as anger and elation are considerably less important in daily living than the nagging worries and petty annoyances that beset us. If you were to make a check list of the number of times during the past week that you consciously experienced various emotions, your tabulations for rage and gloom would probably be very few in comparison with those for mild annoyance or worry.

Worry is essentially a mild fear reaction attached to a future event which may or may not take place. College students report that worry usually comes in the evening during the study period, and the same is true of fear. Worry typically lasts two or three hours, according to students' reports, and is more often experienced during the middle of the week than on week ends, when students tend to relax and "forget their troubles." Many college students report that they become so worried in an examination that they forget simple facts, dates, and formulas that they have studied thoroughly (Meltzer, 1933). Although these reports are sometimes mere alibis through which the student hopes to be excused for failure, in other instances emotional "blocks" certainly do occur.

Annoyance is a mild form of anger. It is usually directed against some other person and, like worry, is also likely to occur in the evening. It is typically of short duration, lasting on the average about twenty seconds. When it passes, it leaves no noticeable after-effects. Anger has about the same characteristics as annoyance except that it is more intense, lasts much longer, and is more likely to motivate the individual to action.

Moods in daily living. Usually an emotion is fairly brief, although subjects have reported outbursts of anger lasting as long as two days. Such long-drawn-out emotions—whether an-

ger, fear, elation, or some other emotion—are usually called *moods*. A mood is generally less intense than an emotion.

Our moods vary with the day of the week and the hour of the day as well as with the seasons.

Two surveys of the moods of male college students, for instance, agreed essentially in finding that students feel "bluer" during the first and last half-hours of the day than at other times; that they feel lower on Mondays than on any other day of the week; and that happiness of mood is highest in spring and summer, lower in the fall, and reaches the bottom during January, February, and March (Springer and Roslow, 1935; Cason, 1931).

Another investigator followed the course of moods of twelve workmen to see how moods were related to working efficiency throughout an entire year. He found that there was a definite periodicity, or fluctuation, of mood which could not be accounted for on the basis of environmental changes or apparent physical condition. The cycle of change from trough to trough ranged from three to nine weeks among the twelve subjects, but in no case did the length of the cycle for a given person vary from his own average by more than a week (Hersey, 1932).

The implications of these and similar findings for daily living are that we should expect daily and seasonal fluctuations in our moods and should not worry when they occur. If, of course, the fluctuations come too fast or if the difference between "up" and "down" moods is extreme, the individual should probably consult some competent psychologist or psychiatrist.

EMOTIONS AS RESPONSES

Two kinds of physical change are involved in emotional responses. The *external* responses of bodily and facial muscles play a direct role in manipulating the environment. In anger, for example, we may hit an enemy—or, if he is too dangerous, withdraw. With smiles and frowns we influence other members of the social group.

The other kind of physical response in emotion is the vast complex of *internal*, or *visceral*, changes. Both the external and internal aspects of physical response will be discussed in detail later in this chapter.

The involuntary activities of the body under emotional stress probably developed as adaptations which helped the organism survive in a hostile environment. The caveman, confronted by an attacking animal, could run faster and longer if he had plenty of sugar in his bloodstream and plenty of air in his lungs. Or, if he had to drive a small beast away from his cave, he could strike harder blows. The changes caused by anger likewise were useful in hand-to-hand combat with his enemies.

When emergencies arise which must be met with immediate and direct action, the visceral changes involved in emotion help the individual cope with the situation in at least three ways:

1. In a state of strong emotion a person is *capable of action over a longer period of time* than would be possible if he were entirely calm. One successful track coach never allowed his milers to run more than three laps of the four in practice, but taught them to run at a winning pace first for one lap, then for two, and finally for three laps. He depended upon the emotional excitement of the actual track meet to carry the runner through the last lap and to supply the burst of energy needed for the final sprint, which so often determines who will win the event.
2. Strong emotion also enables an individual to *exert momentarily his maximum strength*. When a tornado struck, a weak old woman, bedfast with a chronic heart condition, lifted her six-year-old granddaughter, who was standing by the bed, and placed her on the far side of the bed next to the wall. Later she was incapable of such exertion. Combat veterans report similar experiences of sudden bursts of strength or of unusual endurance during crises, especially when survival is at stake.
3. Strong emotion *renders an individual less sensitive to pain*. A college football lineman went into three successive plays with a dislocated knee which under less excitement would have caused him excruciating pain when moved or touched. Shortly after he was taken out of the game, he fainted from agony and exhaustion.

Although emotions are of adaptive value in such emergency situations as these, they can work to our disadvantage on other occasions. Our finer and more complex performances are impaired by very strong emotion. The tennis

player or baseball pitcher who "loses his head" in a game is lost. Stage fright is an illustration of the damaging effect of strong emotion on the individual's ability to execute well-learned verbal responses.

The complexities of modern life also tend to reduce the adaptive value of the organism's physiological mobilization during emotion, for many emergencies arise which cannot be met by direct action. We cannot take a hatchet to the car that refuses to start—or to the boss who refuses a raise. Nor can we run away from our most common fears. In most situations civilization now forces us to express our emotions in words or indirect activities. Unless some satisfactory way can be found to release emotional energy, it may handicap rather than help us in making a satisfactory adjustment. As we shall see a little later, the visceral activity involved in emotion can even result in physical illness if it continues over a period of time.

EMOTIONS AS MOTIVES

The emotions play a vital part in the total picture of our motivational patterns. A life without *emotion* would virtually be a life without *motion*. The similarity between these two words is no accident. Both stem from the Latin verb *emovere*, meaning to "stir" or "upset." Often we speak of a person as "moved to anger" or "deeply moved" by sor-

These children are obviously absorbed in the marionette show they are watching. What is learned with such emotional involvement tends to have more influence on subsequent attitudes and behavior than what is learned only intellectually.



row. Like the drives discussed in the previous chapter, emotions may arouse, sustain, and direct activity in the organism. Thus they play an energizing role in an individual's life.

Like the biological drives, the emotions involve complex physiological changes in the organism. How, then, do they differ?

1. An emotion is a *reaction to a symbol or an external stimulus*. A biological drive, on the other hand, is a response to stimuli associated with certain tissue needs of the organism.
2. The arousal of emotion depends upon the situation's having *significance to the individual*. Two people may react very differently in the same external situation, depending on the emotional meaning that the situation has for each of them. Your favorite professor, toward whom you have pleasant feelings of affection and respect, may be an object of no interest to another student or may even arouse feelings of active dislike. If you fail an examination, you may experience a feeling of determination to do better next time. In the same situation your roommate, however, may develop an attitude of despair. Each person interprets a given situation in the light of his own previous experience, his interests, his values, his self-picture.
3. Whereas the arousal and satisfaction of biological drives may come to follow rather automatic sequences, emotion usually arises in situations where there is *no ready-made, habitual response*. Situations giving rise to emotion often are emergency situations. For example, the thirst you feel when the water supply of your body tissues becomes low is a relatively simple motive and is easily alleviated by drinking a glass of water. The behavioral responses involved in such a situation have come to be habitual and automatic. Suppose, however, that you wake up in the night to discover the room in flames. Your reaction to this emergency situation (to which you have no habitual response) becomes complicated with emotional overtones as you realize the significance of the catastrophe. Your higher-level psychological processes let you foresee the possible consequences of the situation, and your emotionalized apprehension of personal danger and property damage will be a dynamic factor in your subsequent reaction to the emergency.

As motives, the emotions may serve to direct behavior either *toward* some goal which will give pleasure to the organism or *away*

from some object or situation which is unpleasant. In either case we say that the organism's behavior is motivated. Later in this chapter we shall consider the roles of maturation and learning in the development of particular kinds of emotional motivation.

PHYSICAL RESPONSES IN EMOTION

As we have already noted, the conscious content of emotional experience can be studied only by examining the subjective reports of various individuals. Thus we can never be sure that we have a precise description of this aspect of emotion. The physical responses involved in emotion can be observed much more directly and objectively, with the result that psychologists have devoted a great deal of study to them. We shall consider here both the *external* expression of emotion, involving activity of the body and facial muscles, and the various complicated *internal* changes, which are such important components of emotional response.

EXTERNAL EXPRESSION OF EMOTION

The most easily observable indicators of emotion are the external responses of the body and facial muscles.

Overt behavior patterns. The description of human emotions on the basis of corresponding patterns of overt behavior is not at all perfect, and any classification is somewhat arbitrary. However, it is helpful to consider emotional behavior patterns in four broad categories: destruction, approach, retreat, and stopping of response.

Destruction. In anger, attack is the typical behavior. An angry animal or an uncivilized man makes a physically destructive attack—he throws himself upon his enemy, biting, scratching, choking, hitting, spitting, or snarling, according to his species. But with civilized man, the attack is more often symbolic. Words take the place of blows; physical injury gives way to sneering words that are intended to lower the prestige of the enemy in the eyes of his fellows. The end result of

anger is, nevertheless, essentially the same in man and beast—real or symbolic destruction.

Approach. In pleasant emotions the essential response is approach. The biological function of approach to the stimulus object is to permit further stimulation. Elation is essentially an approach reaction which follows success in any activity—or which anticipates success, as the confident athlete becomes elated before an important event.

Retreat or flight. Fear typically involves retreat or flight. Flight from a dangerous situation may be physical or symbolic and is often the best mode of adjustment. Suppose that in crossing a street you hear a horn honk and look up to see an automobile bearing down upon you. You run! Actual flight of this sort is typical in many situations involving physical danger that cannot be escaped by less direct means. Indeed, some people try to escape from more general fears by moving aimlessly from place to place, job to job, or even spouse to spouse. In most of civilized life, however, we “retreat” symbolically through words—apologies, compromises, discussion—and through various psychological mechanisms of “withdrawal.” Typical withdrawal reactions (daydreaming, repressing and forgetting, regressing, and the like) will be discussed in the next chapter.

Stopping of response. Gloom (in more severe form called “grief”) does not involve destruction, approach, or retreat. In such emotion the typical response is a widespread stopping of usual responses. In the extreme form the individual refuses to respond to some of the most potent stimuli. There are patients in mental hospitals, for example, who are too sad to eat and must be fed forcibly. Gloom and grief are not altogether unadaptive, however, since these emotional states may attract the individual's attention to the thing that is wrong in his life and thus motivate him to do something about it.

Facial expression. In normal social conversation we can more or less successfully follow the effects that our words have on the other person by carefully observing his face. It is a barometer of his emotion, perhaps giving warning that our words are too strong, perhaps reassuring us that our listener is not displeased. There are, however, significant limitations on our ability to interpret emotion from facial expression. While the competent professional actor can register emotions that



What emotions do you think are being expressed above? Check with the picture on page 152.

will be interpreted with a high degree of consistency, the facial expressions of the ordinary person are less stylized and cannot be judged so accurately, although they are easier to judge in adults than in children. Some persons seem to have more definite and more easily identifiable patterns of facial expression than others. Moreover, there appear to be considerable differences in the ability of individuals to interpret facial expression of emotions in others. On the question of which part of the face is more expressive—the upper (eyes) or lower (mouth)—the evidence indicates that the expression of the mouth usually dominates (Dunlap, 1927).

Empathy—the ability to understand and, to some extent, share the experience of another person's feelings—depends greatly upon our being able to interpret an individual's expressive behavior. This in turn seems to depend upon our caring for and being interested in that person. Some persons evidently have a greater capacity for empathy than others, but every one of us, in our many personal contacts, learns to judge with some accuracy the emotional reactions of the people we work and play with in daily life. Long association

with a particular person, of course, acquaints us with his peculiarities of emotional expression.

Vocal expression. The adult human voice is even richer than the face in varieties of emotional expression. Changes in inflection, loudness, pitch, or timbre—any of these vocal manipulations may be used to express various types of emotional experience. The rising inflection, for instance, generally conveys a feeling of surprised doubt or incredulity: "What! Is it time to go already?" The rising and falling inflection shows sarcasm: "What a smart idea *that* was!" A slow, dragging monotone expresses defeat and dejection: "I failed the examination." Loud, hoarse, staccato speech with much variation in pitch—characteristic of the football broadcaster—suggests excitement.

All these forms of vocal expression are familiar to us from our everyday experience, and there is no doubt that the sound of a person's voice is a helpful indicator of his emotional state. In most situations, however, voice is only one of many indicators; we are usually aware of the stimulus situation and also can observe the individual's facial expression and overt behavior. But if an observer is unable to see the subject and is ignorant of the stimulus situation, can he identify an emotion on the basis of vocal expression alone? The experimental evidence on this point is meager and inconclusive.

As the child's vocal apparatus matures, patterns of emotional expression become increasingly clear-cut. Although the vocal patterns of emotional response in adults appear to have an innate basis, they are complicated by learning and social imitation. That is, much of our "tone of voice" is determined by social convention, although just how much we cannot say. In anger there is an increase in vocal pitch and loudness which is undoubtedly inborn. The widespread increase in body tension causes more tension in the vocal cords, producing a "raising" of the voice. Quavering and stuttering, typical native expressions of fear, are imitated by the actor who wants to convey the feeling of fear to the audience.

Even adult vocal patterns of emotional expression, however, are not always recognizable. Taken alone, the voice is an ambiguous indicator of emotion; but considered in combination with other information, such as facial expression, bodily movements, and knowledge

of the stimulus situation, vocal expression is a clue which adds to our precision in interpreting emotions in others.

PHYSIOLOGICAL CHANGES IN EMOTION

Of all the indicators of emotion, the most easily measured are the physiological activities that occur throughout the organism. Indeed, many psychologists maintain that these physiological responses *are the emotion*. It is certainly true, at least, that without them there would be no emotion. Whereas conscious awareness of an emotion may be repressed and most external responses can be voluntarily inhibited by the individual, visceral responses are not usually subject to voluntary control. Measurement of physiological changes is thus the most sensitive and objective method of studying emotion and is the source of most of our experimental data.

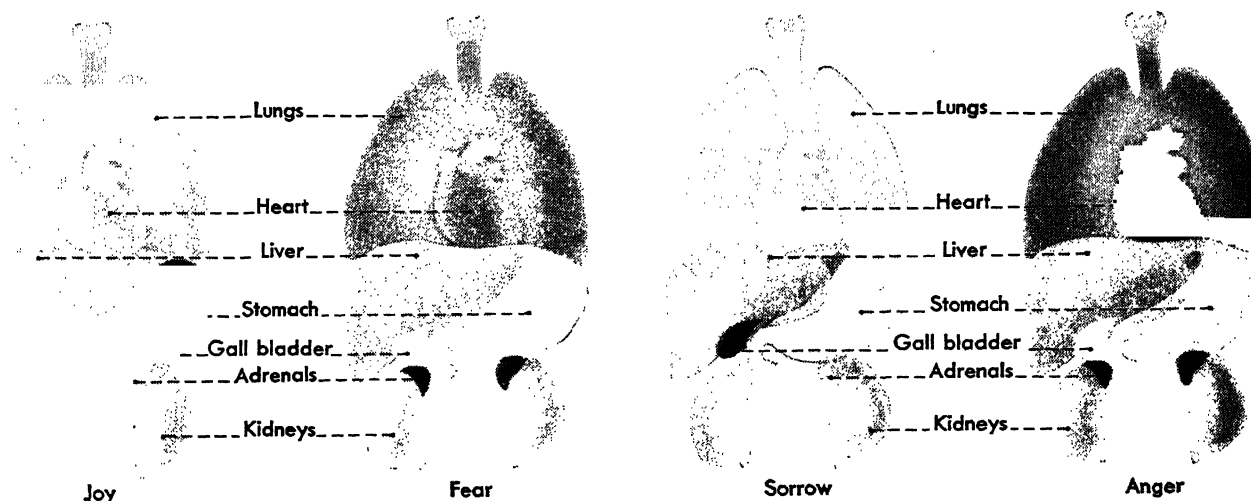
Glandular responses. If you could look directly into the bloodstream of the person experiencing a strong emotion such as anger, you would discover that the medulla of the adrenal gland was pouring an excessive amount of its secretion, *adrenaline*, into the blood. Traveling through the bloodstream to

the various parts of the body, this secretion is responsible for many characteristics of strong emotional experience. Under its influence the liver releases stored sugar into the blood, and chemical changes occur which cause the blood to clot more quickly. Blood pressure rises; the pulse beats more rapidly and more vigorously; the air passages into the lungs enlarge to admit more air. The pupils of the eyes enlarge so that more light may enter. Sweat breaks out all over the body, particularly on the palms of the hands. The temperature of the skin may rise or fall several degrees.

Another secretion of the adrenal medulla, *noradrenaline*, brings about constriction of the blood vessels at the surface of the body, thus making more blood available to other parts of the body. This action also helps prevent loss of blood when a person is wounded. Evidence indicates that the thyroids and the pituitary are also involved in emotional response.

The visceral changes characteristic of four common emotions are illustrated below. These changes are controlled by the *autonomic nervous system* (described on pages 499-501) and are not subject to voluntary control by the individual.

The glandular responses in emotion help the organism to cope physically with emer-



In the diagrams above showing the visceral changes characteristic of four different emotions, the activity of the organ and/or gland is shown by gradations of gray; an organ is darkest when it is most active and white when function is slowed or stopped. In joy the whole body functions efficiently, with the stomach very active. Only one reaction to fear—very active adrenal glands—is shown, but fear often brings changes like those accompanying sorrow and may be superseded by anger. Only the gall bladder is significantly stimulated in sorrow; heart and lung action is slowed. In anger the adrenals and the heart are most active; respiration is increased; and the stomach and gall bladder are inactive.



These teen-agers, and those on page 150, are looking at a window display of \$100,000 in one dollar bills. Facial expression alone is often an ambiguous indicator of emotion, but a knowledge of the total situation can usually aid us in making a correct interpretation of expression.

gency situations. But if the emotion-provoking situation is one which cannot be met directly and which continues over a period of time, the accelerated activity of certain endocrines may actually prove harmful to the organism. We shall discuss this relationship between emotions and health a little later in the chapter.

Neural responses. As with all forms of behavior, intricate patterns of neural activity underlie every emotional response. Because emotion is such a widespread process, affecting nearly every organ and member of the body, almost all parts of the nervous system are involved to some degree in emotional response. Of particular significance in emotion are the roles played by the autonomic nervous system and the brain. These are described on pages 488-501.

Electrical responses. Closely associated with the visceral and neural activity occurring during emotion are certain significant changes in the electrical properties of the body. Two of these electrical phenomena which are of particular interest and have attracted considerable study are the galvanic response and brain potentials.

The galvanic response. Autonomic innervation of the sweat glands during emotion,

causing perspiration to break out on the surface of the body, also produces two important changes in the electrical properties of the skin: (1) the tissues actually generate an electromotive force (voltage) and (2) the electrical resistance of the skin is changed. These changes, which may be measured with great precision by special electrical apparatus, constitute the galvanic response.

Since the sweat glands are innervated by the autonomic system and autonomic activity is under the control of the brain (though not under our *deliberate* control), the galvanic response—in combination with blood pressure and heart rate—becomes a highly sensitive indicator of an emotional response. This fact has been used dramatically in the development of the "lie detector," which is simply a collection of instruments to measure the intensity of various visceral responses that occur during questioning. Because consciousness of guilt engenders a vague fear reaction, certain questions produce an emotional response; others do not. By analyzing the degree of emotion that particular questions produce—by measuring the individual's respiration rate, his blood pressure, and the magnitude of his galvanic response—the skilled operator of the lie detector is usually able to determine with fair certainty whether or not the subject is telling the truth.

The lie detector is not infallible, however, even in the hands of the most skilled technician.

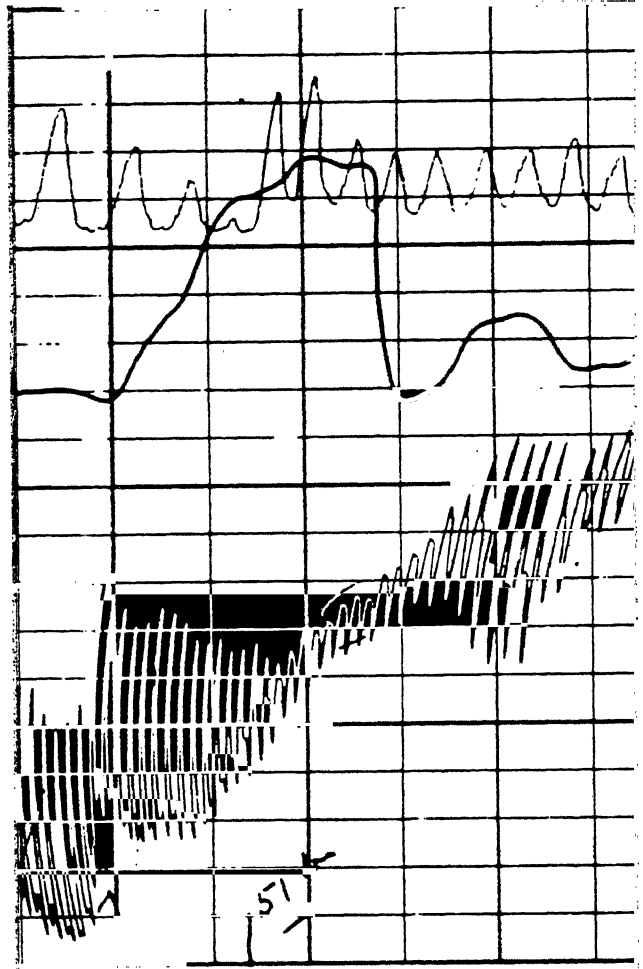
In a complex study conducted at Indiana University in cooperation with the Office of Naval Research, liars were detected 60 to 70 per cent of the time in most of the experiments. The series of tests included experiments in which a single factor alone—such as galvanic response, blood pressure, or breathing rate—was measured in an effort to detect lying. In other experiments various factors were combined. Some of these combinations yielded correct results in 80 to 90 per cent of the cases. The investigators felt that these percentages were the highest that could be expected until further research is done.

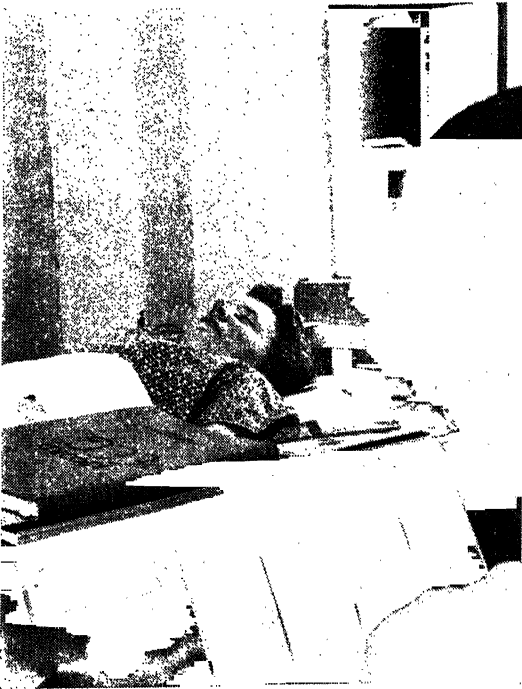
The galvanic skin response gave the best results of any single physiological factor, yielding success in 79 per cent of the cases. In that particular experiment the subjects were asked to circle on a printed list the name of one of the first six months of the year and then to answer "No" to all questions, which were phrased, "Is it January? Is it March?" etc. Thus they would lie one time in six. An interesting result

was that when the students were informed that their lies had been detected and then were retested, using the last six months of the year, only one third as many lies were successfully detected. A second group were told that their lies had not been detected on the first run, and a control group were given no information about results of the first trial. In both these groups about the same percentage of lies was detected the second time as the first (Ellson, 1952).

Experiments such as this throw valuable light on how well lies may be detected by measuring physiological processes. However, the experimenter knew how much the subject was going to lie. In real life the law enforcement officer has no way of knowing whether the suspect is likely to lie about almost everything or whether he will tell no lies at all. Furthermore, some individuals are scarcely suitable for testing. These include the very intelligent, the moron, and the highly nervous person who may react emotionally to nearly all questions asked (Burger, 1952). There is also the so-called "psychopathic personality," who does not possess the normal feelings of remorse or shame in connection with criminal actions, and the "false confessor," who seems to delight in confessing to crimes he did not commit. In spite of these and other limitations to its use, the lie detector is an investigative aid that often brings about justice when other means fail.

In a "lie detector" test (right below) the attachment on the subject's hand measures the galvanic response, while the rubber tubing around his chest and the band on his arm record respiration, blood pressure, and pulse. Changes occur involuntarily when a person tries to lie. In the section of the lie detector chart (right above) the number 51 at the bottom marks the completion of Question 51 by the examiner. The negative sign means the subject answered no. Significant indications that the subject lied are: (1) the two rapid inhalations and the rise in the base line for respiration (top line); (2) the sustained galvanic response (middle line), which began before the question was finished; (3) the pulse rate change, indicated by differences in the frequency of up and down strokes (bottom line); (4) the rise in the blood pressure (bottom line) and (5) the change in position of the dicrotic notch (also bottom line), which shifts from the center to the bottom of the down stroke. This chart segment is unusually dramatic; often the examiner has fewer and less drastic changes to use in interpreting the chart.

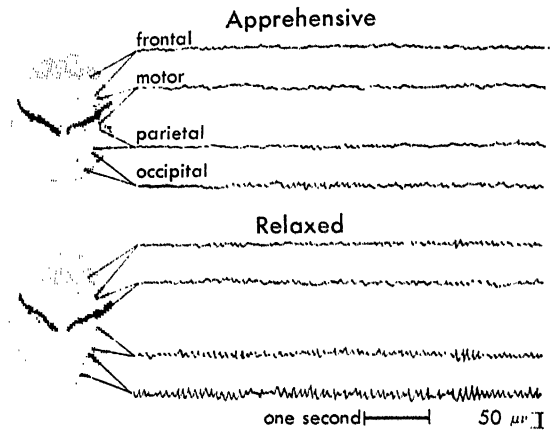




Brain potentials. All the evidence we have considered thus far regarding the function of the brain in emotion has been in terms of its indirect effect on behavior and on physiological changes in other parts of the body. During recent years, however, it has been possible to study the activity of the brain directly by measuring the changes in certain minute electrical oscillations that are constantly being given off by the cerebral cortex. These rhythmic electrical "beats" are recorded by a large and delicate instrument called an *electroencephalograph* (EEG), which is connected with electrodes placed on the scalp over the cortex.

Although the cortex produces a number of different varieties of "brain waves," the predominant activity revealed by the EEG is a beat of about ten oscillations per second, called the *alpha rhythm*. (See page 497.) When the brain is at rest these oscillations remain fairly regular, but under the influence of disturbing stimuli the alpha rhythm becomes irregular or is "blocked" entirely. Sleep and anesthesia produce large, slow alpha waves, whereas alertness and excitement are accompanied by small, rapid waves.

The nature of these changes in the alpha rhythm during emotion are clearly shown in



In obtaining EEG's the subject sits or lies comfortably while electrodes placed on the scalp relay to a moving paper the electrical activity going on in the four areas of each side of the brain (left). The eight currents are thus recorded in parallel form. Above are EEG records (for one side of the brain) taken when the subject was apprehensive and then when he was relaxed.

the figure above, which illustrates the state of apprehension as compared with a relaxed, nonapprehensive state. These records were taken from the same normal subject but at different times. When first brought in for the EEG session, the subject was tense and worried about the procedure. The top record, taken during this initial apprehensive period, shows the reduction or suppression of the alpha rhythm. This is characteristic of emotional disturbance. The bottom record, taken a few minutes later after the subject had lost his uneasiness and become relaxed, shows the larger, more prominent waves typical of the quiet, unaroused state (Lindsley, 1950).

EMOTIONS AND HEALTH

Modern medicine has come to recognize the importance of emotional processes as a factor in physical health. Within the past two decades there has developed a new medical specialty, *psychosomatic medicine*, devoted to the diagnosis and treatment of bodily ailments which result at least partially from sustained emotional tensions. These should not

be confused with the neuroses and the psychoses, to be discussed in the next chapter.

PSYCHOSOMATIC REACTIONS

The physiological changes that accompany emotion make possible the excessive expenditure of energy frequently necessary in coping with an emergency situation. It is understandable that the complex physiological factors which accompany emotion are referred to as the *emergency reaction*.

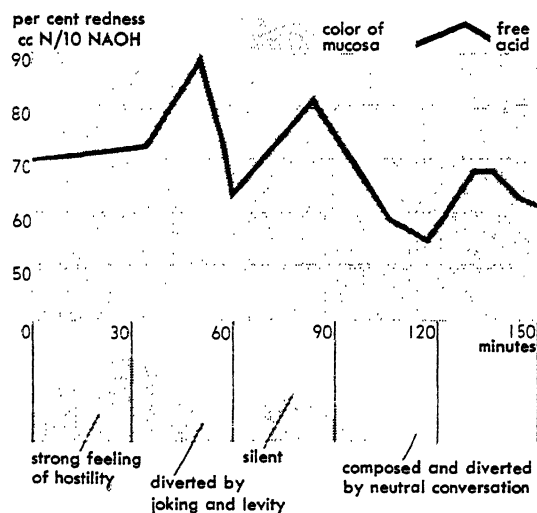
The emergency reaction is viewed as the normal physiological consequence of some emotion-provoking situation, usually one eliciting fear or anger. In the majority of instances the organism soon copes with such a situation in one way or another. The various physiological activities accelerated by the emergency reaction thereupon return to normal levels.

It sometimes happens, however, that the individual does not consciously recognize the significance of the emotion-provoking situation and consequently is unable to cope adequately with it; or he is aware of it but conditions are such that no escape from the situation is possible, as in the case of a soldier in combat. This may result in maintaining an extreme level of physiological activity over a much longer period than is usually true with emergency reactions. If this state of physiological "mobilization" continues for a sufficiently long period of time, actual tissue damage may occur. The term *psychosomatic disorder* is used to refer both to the symptoms involved in a persistent emergency reaction and to the actual tissue damage that results.

It is estimated that about half of all patients going to physicians have illnesses precipitated largely by emotional disturbance. Emotional factors have been clearly demonstrated in the development of peptic ulcers, high blood pressure, colitis, migraine, dermatitis, obesity, and asthma (Alexander and Szasz, 1952; Halliday, 1953; Sequin, 1950; Wolff, 1953). A more commonplace example of the role of emotion in our body chemistry is the recent finding that tears secreted during emotion have more albumin in them than tears induced by an onion (Brunish, 1957).

Illnesses can often be recognized as psychosomatic by the fact that they occur only when the individual is in a particular situa-

Changes in Gastric Physiology Associated with Feelings of Hostility



This graph was drawn from observations made on a patient whose stomach was open for scientific study. The patient started out feeling resentment and hostility as a result of a humiliating experience. While he discussed it, his hostility increased, and there was a greater flow of acid in his stomach and more redness of the mucosa. With changes in his mood, there were corresponding changes in gastric physiology (Wolff and Wolff, 1947).

tion, disappearing if the environment is changed and recurring if the individual has to return to the way of life which originally caused him to become ill. Situations that are ordinarily considered happy may be the source of anxiety to a psychosomatic patient. This is shown in the case of a twenty-seven-year-old girl whom we shall call Louise.

Louise's symptoms, consisting of depression, headaches, vaginal pain, and a sensation of "pins and needles," became so severe at the age of twenty-one that she had to break her engagement to a man with whom she was deeply in love. She got along pretty well for a time, except that such pastimes as dancing often aroused her symptoms. Nearly six years later she met and became engaged to another man. Then she became so ill that the marriage was postponed. When her fiancé returned from overseas service and a new date was set for the wedding, she suffered a relapse and sought psychiatric treatment.

One source of anxiety for Louise was her fear that she would become mentally ill like her mother, who had been in a mental institution for twenty years. During this period Louise's father had lived with his housekeeper, by whom he had seven illegitimate children. Louise, who lived with her grandmother most of this time, was torn between love for her father and love for the grandmother, who disapproved of the father's actions. Also she was very jealous of the illegitimate children and had often wished the housekeeper's babies would be born dead. When she was sixteen, Louise went to work as a maid. Her employer was extremely religious and, by insisting that Christ's second coming was near, added to the girl's feelings of fear and guilt. She went so far as to vow never to marry but to sacrifice her own happiness for her father's salvation.

All these factors had combined to give Louise a great fear of sex and childbirth and a feeling of guilt which prevented her from enjoying life in a normal way. After only a short period of therapy, however, her physical symptoms disappeared. She



In an experiment at Walter Reed Army Institute of Research to learn more about psychosomatic disorders, electric shocks were given to the feet of two monkeys every twenty seconds (when a red warning light burned) during alternating six-hour periods. If the monkey on the left pressed the lever attached to the box in front of him, the shock for both monkeys was postponed twenty seconds. To stave off the shocks indefinitely, he therefore had to press the switch once every twenty seconds. When he slipped up, both received a shock. The monkey on the right had a dummy lever, which he soon ignored. The first time this experiment was tried, one monkey died on the twenty-third day with what looked like an ulcer. His companion was in excellent health. Which monkey got the "ulcer"? The executive monkey on the left.

then married her fiancé, who had shown great patience and understanding while she was ill. Two years later Louise wrote to the therapist saying that she was happy in her marriage and was the mother of a new baby girl (Stekel, 1954).

Many studies with animals have shown that prolonged stress often results in tissue damage. Peptic ulcers, for example, have been produced experimentally in animals subjected to stress-provoking situations.

In one study nine rats were kept in a large rectangular box for thirty days. There was food at one end of the box and water at the other, but the floor around the food and water was constantly charged with electricity. If a rat left the central section of the box to eat or drink, he received a shock. Only during every forty-eighth hour was the current turned off. Thus the rats experienced a chronic conflict between desire to obtain food or drink and desire to avoid shock. A control group of five rats were given food and water only at forty-eight-hour intervals, but they were not put in the conflict situation. Six of the nine experimental animals developed peptic ulcers, whereas none of the controls did (Sawrey and Weisz, 1956).

These results were confirmed in a later experiment in which more animals were used and conditions were systematically varied to determine the relative contributions of hunger, thirst, shock, and conflict to the production of ulcers (Sawrey, Conger, and Turrell, 1956). This study made it clear that emotional conflict contributed significantly to ulcer formation. Hunger added to shock also contributed significantly, but thirst did not.

Because of the close interaction between mind and body in the development of psychosomatic disorders, it is often difficult to distinguish whether the patient's complaints are primarily psychological or physiological in origin. Even in cases where psychological factors are obviously the *precipitating* cause, certain physiological factors may *predispose* the patient to display the particular physiological symptoms which appear. Often the symptoms of psychosomatic and purely organic disorders are so similar—as in bronchial asthma, for example—that it is extremely difficult to tell whether the patient's primary need is medical treatment or psychotherapy.

Physicians are coming to realize that even when the patient's symptoms are due primarily to physical causes, emotional strain

can very definitely work against successful medical treatment. The emotionally unstable person who suffers from some severe organic disorder may become so depressed by his physical condition that he will actually lose the normal recuperative powers possessed by patients with greater emotional stability. This has been found to be particularly true in such organic disorders as tuberculosis, heart disease, diabetes, and epilepsy. In tuberculosis, for example, care must be taken to avoid aggravating the patient's condition by emotional disturbances, since he is not allowed to engage in vigorous physical exercise and is thus denied an important natural means of working off his emotional tensions. Unless efforts are made to maintain a cheerful mood for the patient, a disease which is essentially organic in origin may be intensified by emotional factors.

GENERAL-ADAPTATION-SYNDROME

A theoretical approach which helps explain psychosomatic symptoms is the concept of the *general-adaptation-syndrome*, developed in recent years by a prominent endocrinologist, Hans Selye (Selye, 1953, 1956). According to Selye's theory the body's reaction under stress occurs in three major phases: the alarm reaction, the stage of resistance, and the stage of exhaustion.

1. The *alarm reaction* is the organism's first reaction to the application of any stress-provoking agent, or *stressor*. A stressor is anything injurious to the organism, either physically (such as inadequate food, loss of sleep, bodily injury) or psychologically (such as loss of love or personal security). The alarm reaction consists of various complicated bodily and biochemical changes such as those associated with emotion. These physiological changes usually have the same general characteristics regardless of the exact nature of the stress-provoking stimulus. This accounts for the similarity in the "general" symptoms of people suffering from various specific illnesses—all seem to complain of such common symptoms as headache, fever, fatigue, aching muscles and joints, loss of appetite, and a general feeling of being "run down."

In an experimental situation set up to test this theory, a large number of animals were subjected to a wide variety of stressful conditions including starvation, infections, poisoning, extreme cold, extreme

heat, surgical hemorrhage, and others. The physiological reactions which resulted were not altogether specific to the stress-provoking condition but rather consisted of a general pattern of change which was much the same for all stimulus situations (Selye, 1950).

2. If exposure to the stress-producing situation continues, the alarm reaction is followed by the *stage of resistance*, the second phase of the general-adaptation-syndrome. Here the organism seems to develop a resistance to the particular stressor which provoked the alarm reaction, and the symptoms that occurred during the first stage of stress disappear, *even though the disturbing stimulation continues*. Resistance to the stressor seems to be accomplished in large part through increased activity of the anterior pituitary and the adrenal cortex, whose secretions (*corticotropin*—or ACTH—and *cortin*, respectively) help the organism adjust to stress. The physiological processes disturbed during the alarm reaction now appear to resume normal function.

3. If exposure to the injurious stressor continues too long, a point is reached where the organism can no longer maintain its stage of resistance. It thereupon enters the final phase of changes related to stress, the *stage of exhaustion*. The anterior pituitary and adrenal cortex are unable to continue secreting their hormones at the increased rate, with the result that the organism can no longer adapt to the continuing stress. Many of the physiological dysfunctions which originally appeared during the alarm reaction begin to reappear. If the stressor continues to act upon the organism after this time, death soon occurs. Fortunately, severe stress is usually relieved before the stage of exhaustion is reached.

Individual reactions to emotion-provoking situations vary. The action of the adrenal glands, for example, is different in different people who are subjected to the same kind and amount of stress. This seems to depend partly upon their earlier experiences, as was indicated in a two-year study of Harvard students who were subjected to experimentally induced stress.

In some students the heart and blood vessels behaved as they would if the student had received an injection of adrenaline, a hormone secreted by the adrenal glands (see page 48). These were the students whose primary reaction to the induced stress

was anxiety and fear or a feeling of anger directed inward toward themselves. In the other group, who tended to experience anger directed outward, the behavior of the heart and blood vessels followed quite a different pattern.

When the students filled out a questionnaire concerning their childhood discipline, it was found that the "anger-out" group had nearly all had fathers who played a dominant role in discipline and who had been strict. The "anger-in" or adrenaline-type reaction group, on the other hand, for the most part had mild fathers who usually shared equally with the mother in discipline or even allowed the mother to be dominant. This may indicate that childhood control causes certain reaction patterns which remain fairly constant in later life. Although further research is needed, this study indicates that even involuntary reactions to stress are influenced by a complex set of factors (King and Henry, 1955).

Another interesting fact has been brought to light by some studies made in connection with the general-adaptation-syndrome—namely, that in building up resistance to one stress-provoker, the organism apparently suffers reduced ability to resist other stressors. It is as though the organism's adaptation to one stressor were acquired at the expense of lowered resistance to others. Thus mice which are exposed to extremes of cold appear to develop resistance to the cold but become unusually sensitive to X-rays. Similarly, animals injected with large doses of morphine become unusually sensitive to cold. The same principle seems to apply in cases of psychologically induced stress. A soldier in combat, for example, may become so well adapted to the stressor of physical danger that he shows no outward reaction of fear; *but* if an additional stressor is introduced, such as bad news from home, he may become physically ill. If, on the other hand, he were not already resisting the fear-induced stress, he might be able to adapt to the same bad news without apparent physical consequence. This theory makes it possible to explain the fact that in one case a severe psychological stress will produce severe physiological disorganization, whereas in another case no ill effects will be noted.

The concept of the general-adaptation-syndrome has proven exceptionally valuable in explaining psychosomatic disorders. In terms of its framework, many disorders can

be viewed as the results of stress or of the physiological processes involved in adapting to stress. Similarly, it becomes possible to account for the value of cortisone and ACTH in treating various diseases. In effect, such treatment may be regarded as a way of helping the anterior pituitary and adrenal cortex maintain resistance to some stressor. The theory of the general-adaptation-syndrome promises to modify the treatment of both physical and psychological disorders.

HOW EMOTIONS

DEVELOP

How does man become the emotionally complex person that he is? What are the origins of his morbid fears, his daily annoyances, his fine sentiments of patriotism and loyalty? To what extent do these result from maturation and to what extent are they the product of learning?

EARLY EXPERIMENTAL FINDINGS

Many strange superstitions have guided people's thinking on the question of which emotions are inborn and which are developed in the process of social living. It was commonly believed in the past, for example, that children have instinctive fears of many things—furry and feathery objects, fire, darkness, reptiles, and so on. Only within the last half century have psychologists systematically tested the validity of such notions in an attempt to arrive at a scientific understanding of emotional life.

Testing for inborn emotions. Experiments conducted by John B. Watson and the behaviorist school of psychology in the 1920's added greatly to the understanding of emotional development. Although some of his assumptions and conclusions have been considerably modified by later investigators (page 161), Watson made a very significant contribution by successfully challenging the notion, popular at the turn of the century, that most common emotional patterns were purely instinctive. He also stressed the need to ob-

serve the behavior of infants during their early months of life in order to understand the development of emotion.

After observing a large number of infants, Watson decided that there were only three discrete, identifiable emotional responses to be seen in the young infant: fear, rage, and love.

Watson concluded that these dimensions of emotional response were inborn, "belonging to the original and fundamental nature of man." The response of fear he identified with "... a sudden catching of the breath, clutching randomly with the hands ... sudden closing of the eye-lids, puckering of the lips, then crying." Distinguishable from fear was the rage response: "The body stiffens and fairly well-coordinated slashing or striking movements of the hands and arms result; the feet and legs are drawn up and down; the breath is held until the child's face is flushed." Finally, love was described by Watson in the following manner: "If the infant is crying, crying ceases, a smile may appear, attempts at gurgling, cooing. . ." (Watson, 1924).

Watson attempted to provoke these varieties of emotional response in infants and young children by confronting them with all manner of stimulus situations which, according to popular belief, were supposed to arouse emotional behavior. For instance, popular notion had held that babies and young children instinctively fear furry objects. Watson was the first to put this idea to scientific test.

His subjects were babies four to five months old who had been hospital-reared in virtual isolation from the numerous emotional stimuli normally encountered by babies reared in the average home. These babies were presented with stimuli which were thus experienced for the first time and under laboratory conditions, with trained observers carefully recording their responses.

In the first test of this series a lively black cat was shown to infants. The children invariably reached out to touch the animal's fur, eyes, and nose. When a rabbit was presented, the responses were essentially the same except that a child often would grasp the ears in one hand and thrust them into his mouth. No evidence of fear of the furry rabbit was obtained in any of the subjects. When friendly Airedales, both large and small, were presented, the results were similar, except that with the large dogs little manipulatory behavior was observed. Since these

children, with no previous opportunity to learn, showed no fear of any of the animals used, Watson concluded that the prevalent beliefs that children instinctively fear furry objects were just "old wives' tales" (Watson, 1926).

Other conditions which should have provoked emotional reactions, according to popular belief, failed to do so when experimentally tested. After exploring various stimulus possibilities, Watson concluded that the principal situations which elicited the fear response were loud sounds and loss of bodily support. Similarly, rage could be provoked by restraining bodily movement. The response of love was produced by stroking or manipulating various body areas. Watson's conclusion, then, was that the stimuli which elicit emotion—*prior to learning*—are decidedly limited.

Conditioning emotions in children. In addition to pointing out the inadequacies of the instinct theory of emotions, Watson and the



Many fears once thought to be instinctive are actually learned. For example, the boy above has made pets of two tarantulas, giant spiders which frighten and repel most people.

behaviorists demonstrated the great importance of conditioning in emotional development. We have already seen in our discussion of acquired drives (page 136) how children learn to seek previously neutral words and objects as rewards, because they are associated in various ways with the satisfaction of basic needs. Similarly, children learn to *fear* and *avoid* previously neutral objects which become associated with painful or unpleasant experiences.

Watson reported a now famous case of an eleven-month-old boy, Albert, a remarkably happy child who prior to any experiments was rarely seen to cry. After repeated tests were conducted to see that nothing but loud sounds and loss of bodily support would evoke a fear response in the child, an attempt was made to see whether he could be conditioned to fear a white rat. The results of this experiment were unmistakably clear.

A previous test had shown that Albert had no fear of the white rat. At the beginning of the conditioning experiment the child was suddenly presented with the animal. He reached for the rat, and just as his hand touched it a loud sound was made by striking a metal bar behind the boy's head. This elicited a startle reaction, but Albert did not cry. The child reached for the rat a second time. Again, just as he touched the animal, the bar was struck. This time Albert jumped violently and whimpered.

A week was allowed to elapse before any further conditioning trials were attempted. Then, on the first trial, the rat was suddenly presented alone without the sound. The child was hesitant in reaching for the animal and upon contact with it withdrew his hand suddenly. Several additional trials followed in which the rat was presented in combination with the loud sound. Each time the boy exhibited startle responses. On the later trials he whimpered or cried. Finally the rat was again presented alone without the loud sound. This time the child began to cry immediately, turned from the animal, and began to crawl away rapidly (Watson, 1926).

Here is evidence of how a fear response becomes attached to a stimulus that was previously neutral. For Watson, such a finding was important in explaining the manner in which emotions eventually could be elicited by a much larger variety of stimuli than was the case during infancy. In effect, new objects come to elicit emotional responses which originally are related to a very small number of

innate fears. By a process of stimulus "substitution," the child "learns" to fear an ever increasing number of objects as his experience broadens.

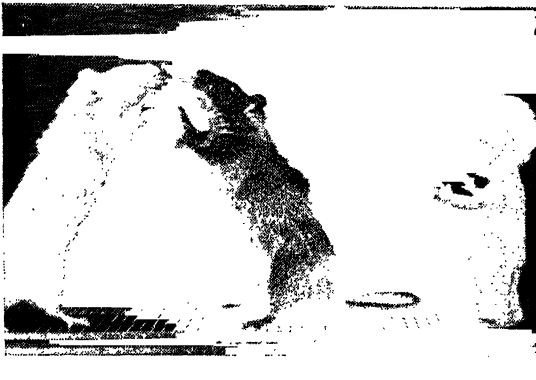
Stimulus generalization. Watson conducted further experiments to find whether a person who has been conditioned to fear one object will develop fears of similar objects. Before he was conditioned to fear the white rat, Albert had been playing with fur muffs, false faces, rabbits, pigeons, and other similar objects without the slightest indication of fearing any of them. He was not allowed to see any such objects during a five-day period following his last conditioning contact with the white rat. On the sixth day he was tested again.

Albert was first presented with blocks that he had played with during the intervals between his earlier conditioning trials with the rat. He played with them readily, indicating that none of the conditioned fear had transferred to the blocks. But when again presented with the rat, he whimpered and turned away. Undoubtedly the conditioned response to the rat had carried over the five-day period.

The infant was next shown, in order, a rabbit, a dog, a sealskin coat, cotton, wool, human hair, and a Santa Claus mask. Each of these stimulus objects elicited negative responses, although the child's reactions were stronger and more pronounced to the animals and the fur coat than to the other objects, which bore less similarity to the rat. Whenever he was presented with the wooden blocks, he played with them as readily as before the conditioning (Watson, 1926).

Thus we see how a conditioned response of fear for one object may spread to other similar objects. This process, known as *stimulus generalization*, further complicates the development of emotional responses. Notice that the degree to which Albert's fear response spread from one object to others was in general proportionate to the amount of similarity between the new objects and the rat.

An interesting example of stimulus generalization is shown in the pictures at right. In this study rats were trained to strike at each other as they do at the beginning of a fight. This was accomplished by placing two rats in an enclosure, the floor of which was a grid through which they were given an electric shock. Whenever they happened to approach each other in a sparring position, the shock



was cut off. After a minute without shock the current was turned on again. Soon the animals learned to begin striking each other vigorously as soon as the shock began.

Then a celluloid doll was placed in the enclosure with the rats. The animals continued to strike at each other and not at the doll. But when they were placed in the enclosure one at a time with the doll, the rats struck at the doll. When a control group of untrained rats were placed one at a time in the enclosure with the doll and given a shock, only one struck at the doll, showing that the tendency to strike the doll was the result of training. The striking response, learned

in connection with other rats, had been generalized to include the doll (Miller, 1948).

This kind of generalization helps explain such situations as when a child who is accustomed to getting his own way at home by tantrums tries the same tactics at school.

Such experiments form the basis of the behaviorist theory that emotional life becomes complicated as a few basic emotional reactions spread—through learning—from one situation to another. They should also give you some insight into why you may immediately dislike some person upon first meeting him. A negative emotional reaction attached to one person through some unpleasant association can transfer to someone else who bears a resemblance to him, even though you are unaware of the resemblance between them and may not even be thinking of the original individual.

MATURATION AND LEARNING IN EMOTIONAL DEVELOPMENT

Watson and his followers were so keenly intent on studying the environmental factors in emotional development that they neglected the important role of maturation in determining the growth of emotional complexity. Gradually, too, other experimenters have discovered that even the problem of conditioning emotional responses is not quite so simple as the results of the early behaviorists seemed to indicate. Criticisms of Watson's work have centered on the following main points: (1) the nature of the stimulus is more important than Watson realized in determining whether or not an individual can be conditioned to respond to it emotionally; (2) maturation as well as learning is involved in the growth of emotional complexity; (3) individual differences in the pattern of emotional response are greater than Watson realized; and (4) loud sounds and loss of bodily support are not the only stimulus conditions which will produce the fear reaction, which rather can be aroused by almost any unexpected and intense stimulus.

The nature of the stimulus. Watson believed that children could be conditioned to fear any object. In some later experiments, however, attempts to condition emotional responses have notably failed.

One psychologist attempted to condition a child to fear a pair of opera glasses and a caterpillar by associating each of them with the sound of a loud whistle. The fear response was invariably aroused by the loud whistle and, through conditioning, by the caterpillar. But it could not be conditioned to the opera glasses (Valentine, 1930).

This failure to establish a conditioned fear of the opera glasses raises such a fundamental issue that we must pause to examine still more convincing evidence.

Another psychologist presented the sound of an electric bell simultaneously with a wide variety of objects which had no known relation to the needs, appetites, or biological aversions of the infants in the experiment. The sound of the bell produced a fear or startle response in the infants, but it was impossible to condition this response to the biologically neutral stimuli, such as a cloth curtain, wooden blocks, and rings, even when a large number of trials were given (Bregman, 1934).

Apparently, then, there is a hierarchy in emotional stimuli. At one end are such things as loud sounds and loss of bodily support which will bring a fear response the first time they are presented—stimulus situations which infants fear “instinctively.” Then there are neutral objects, such as opera glasses, toward which fear cannot easily be built up. Finally, there are such living objects as rats, rabbits, snakes, dogs, and caterpillars which children can be conditioned to fear in a few trials. The nature of the stimulus seems to have a definite limiting effect on the conditioning theory of emotional development.

Emotional response to symbolic stimuli. An emotion-provoking stimulus need not be a real-life situation. It may be just a symbol, such as a spoken word or phrase, which represents some situation or activity. As the child grows up and learns to use and understand more and more words, these words take on emotional connotations. Some words become fear-some, others pleasurable, and still others disgusting.

You will remember from the previous chapter how the desire for social approval conditions the child to react positively or negatively to certain symbols. If, whenever a child does something his mother disapproves of, she frowns and says “Bad,” the word *bad* will come to have the same significance for behavior that the frown has. If the word *bad* is

reinforced with a slap or with the removal of some desired toy, it will become even stronger as a stimulus. Through the use of language children may come to fear nonexistent things, such as “bogeymen” and ghosts.

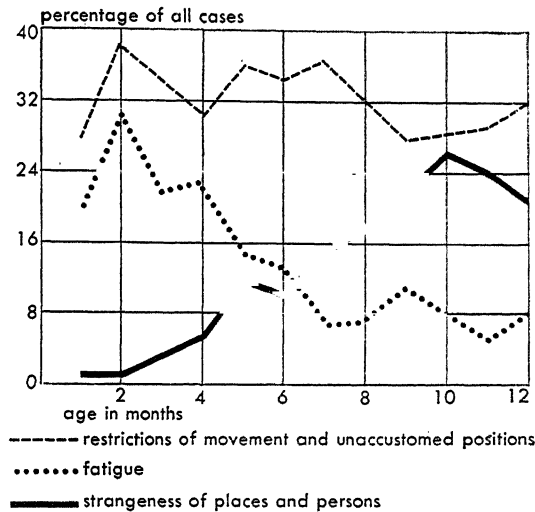
Words, however, are just one of an infinite variety of symbols that can arouse an emotional response. The figure of a bear, a tiger, a badger, or even a purely fictitious creature like a Jayhawk may arouse warm feelings of loyalty in a student from, respectively, the University of California, Princeton, the University of Wisconsin, or the University of Kansas. Or, at the homecoming game, the same symbol may produce hostile excitement in the members of the opposing team. Thus, through the process of learning, symbols as well as objects may serve as stimuli which elicit emotion.

The maturation factor. Although learning is undoubtedly important, many studies have indicated that maturation cannot be ruled out as an important factor underlying the emergence of emotional response patterns. Certain emotions not observable in infancy appear almost universally at a later age. Also, in emotional patterns, as in other types of development, maturation brings increasing differentiation and specificity of perception and behavior. Several studies have indicated the great importance of maturation in the development of fears in children.

In one study, observations were made of the crying behavior of sixty-one infants. The babies were put through a series of test situations every month during the first year of life, with special attention being paid to crying from fear in strange surroundings. This type of fear behavior occurred when the child was brought into strange rooms or when he was taken from the mother by a stranger. The fear behavior disappeared when the baby became accustomed to the strange person or room. The results of these successive monthly observations showed that crying from fear of strange surroundings is absent during the first two months, but by the age of ten months approximately one fourth of all the baby's crying responses are attributable to fear of strange surroundings (Bayley, 1932).

Why should crying from fear of strange surroundings become relatively more frequent as the infants get older? One explanation would be that the babies became conditioned to fear new situations. This is possible but not probable. Care was taken in the above experiment not to harm the infants or in any way to per-

Changes in Crying Behavior of Infants in Response to Different Stimuli



mit the association of strange persons and situations with already present fears. A more probable explanation is that with increase in age comes an increase in intelligence and, consequently, a clearer perception of whether surrounding things and persons are familiar or strange. By and large these results seem to demonstrate the roles of maturation and of indirect learning in the growth of emotional behavior.

Additional evidence comes from a study of the emotional responses of children and adults suddenly confronted with a large and active snake. As a result of their observations the experimenters came to the following conclusions: "In our group of 51 children and about 90 adults, children up to the age of two years showed no fear of a snake; by three or three-and-a-half, caution reactions were common; children of this age paid closer attention to the snake's movements, and were somewhat tentative in approaching and touching it. Definite fear behavior occurred more often after the age of four years, and was more pronounced in adults than in children. No sex differences were observed . . ." (Jones and Jones, 1928).

Here, too, the behavior seems to reflect a general maturation of intelligence, with a resulting increase in sensitivity and discrimination. As the child matures, he builds up more definite expectations regarding life situations. A baby of twelve months probably will not be especially surprised to find a snake in a black box, for example, because he has not

had enough experience to know that this is unusual. A typewriter in the box might seem every bit as strange to him as the snake. As the child learns what to expect in given situations, however, he will tend to become fearful of things that are unfamiliar or do not fall into the expected pattern. Our emotional reactions, then, are apparently shaped both by our experiences with our environment and by the maturational level of our perceptual and intellectual capacities.

Differentiation of emotions in infancy. The differentiation of emotions during the first two years of life has been clearly described in an extensive study of the emotional behavior of sixty-two infants in the Montreal Foundling and Baby Hospital (Bridges, 1932).

Daily observations were made of the infants' emotional behavior, and careful records were made not only of their responses but also of the varied conditions which elicited them. It was discovered that as early as the second week after birth certain strong stimuli give rise to the generalized response of excitement. This is the only type of emotional response apparent during the first few weeks and is regarded as the original emotion from which all other emotional patterns develop. Behavioral indicators of excitement in neonates include tensing the arm and leg muscles, breathing more quickly, opening the eyes, and gazing into the distance. Stimuli found to elicit excitement in the infants included direct sunlight shining in the eyes, restraining the arms, rapping the knuckles, pressing the bottle nipple into the mouth, and the clatter of a tin basin on a metal table.

At an early age general excitement becomes differentiated into the *pleasant* and *unpleasant* emotions, although the records show that it also continues to appear in undifferentiated form throughout the first two years of life, and other studies have revealed its presence in adults.

Among the *unpleasant* emotions, distress can be distinguished by the time the baby is three weeks old. It is elicited by unpleasant stimulus situations, such as struggling for breath, lying on wet diapers, chafed buttocks, and waiting to be fed. The response pattern in distress appears to differ from that of general excitement in several details. In distress there is greater muscle tension, more interference with breathing, and frequent closing of the eyes; crying is louder, more irregular, and higher pitched. In infants over two months of age the eyes become moist and tears may flow in distress, which does not happen in general excitement at any age. The eyes are "screwed up" tight, the face becomes flushed, the



Emotions are easily distinguished in the young infant. They are also usually stronger, less controlled, and of shorter duration than will be true in later years. In the pictures above, the baby's emotion changes from delight to distress in a period of a few moments.

fists clench, the arms tense, and the mouth becomes distorted. According to these studies, distress later becomes differentiated into the other unpleasant emotions of anger, fear, disgust, and jealousy.

By the fifth month the baby shows unmistakable anger reactions when some interesting activity is interfered with. At this age the normal baby has formed attachments to small objects such as rattles, stuffed animals, and his milk bottle, removal of which may elicit the distress response or may give rise to anger. The clearest sign of anger that distinguishes it from distress is a protesting wail without the closing of the eyes.

The Montreal studies show that disgust reactions also are clearly recognizable during the fifth month of life. These include coughing, sputtering, frowning, and crying while being fed. Cereals, milk, and sweetish foods are usually accepted with evident enjoyment, but some babies who were observed showed disgust at chopped vegetables, bitter foods, and soup that was too thick.

By seven months of age fear reactions are clearly observable. The most frequent stimulus to fear at this age is the presence of a stranger. The behavior pattern in fear includes a general inhibition of all movement followed by a burst of tears or by steady crying. The body remains rigid and inactive, the eyes close tightly, and the head bends. If the stranger touches the infant, he turns away. These reactions become more marked with the passage of time, until by the twelfth month the fear pattern is easily evoked by sudden withdrawal of support. Current evidence indicates that almost any unexpected, strong stimulus, such as a sudden flash of light, will produce fear in the infant.

Between the fifteenth to eighteenth months, the Montreal studies show, the emotional reaction of jealousy appears. The attention of familiar and

interested adults is highly prized at this age. When such attention is withdrawn from a baby, and particularly when it is bestowed upon another, a violent jealousy reaction may occur. Typically the jealous child stands stiffly, motionless, head bent forward, and bursts into tears. Some children will show definite anger and aggression, directed against a rival child, frequently ending in hitting, hair pulling, or even biting and scratching. Jealousy appears to have elements of both fear and anger. It is usually evoked by the actions of adults rather than of other children, except as another child is the recipient of adult attention.

The first recognizably pleasant emotions do not emerge clearly until several weeks after the appearance of distress. The baby under a month old is either calm and quiescent or else he is excited. Gentle stroking, swaying, and patting soothe the infant and induce sleep, but no positive reaction of delight is yet observable in any distinctive facial reaction or bodily response. By the second month the baby smiles fleetingly when nursed, warmly wrapped, rocked, tickled gently, fondled, or spoken to by the nurse or the mother. By the third month the emotion of delight has become quite clearly differentiated. Delight differs from distress in producing free as against restrained movements of the body; open rather than closed eyes; smiles instead of frowns; movements of approach rather than withdrawal; vocalizations of lower pitch than in either excitement or distress; and more or less rhythmic movements of the arms and legs.

By the seventh month the baby is becoming more and more interested in small objects and is trying to reach for and grasp them even when they are outside his reach. When these efforts succeed, there is a typical emotional reaction which has been called elation. The baby smiles, takes a deep breath,

and appears to express satisfaction in a sort of grunt. After the object has been examined for a while, it is discarded, and some new one attracts his attention. This sort of activity becomes more frequent, and by the eighth month the noise made when he bangs a spoon is especially productive of elation, though throwing things out of the crib runs a close second. Learning to walk, a little later, is never-ending fun.

By eleven months of age the average baby shows many signs of love or affection for adults. He puts his arms around the neck of the nurse or mother, stroking and patting her face with obvious delight. He will sometimes bring his lips close to the adult's face in incipient kissing movements. At first, affection is evoked only by familiar adults, other babies being ignored. By the fifteenth month, however, babies show definite affection for each other. They hold each other's hands, pat each other and smile, put their arms about each other, and sometimes kiss each other. This sort of behavior continues, and by the eighteenth month there is a great deal of loving jabber of nonsense sounds. The affectionate reaction to other babies and to adults becomes selective, certain individuals being preferred.

By the eighteenth month babies show a great deal of affection for each other, although they continue to hit each other when the situation arouses anger. It is interesting to note that children of this age show no preference for other children on the basis of sex. Nor is there any evidence that older children protect younger ones.

The Montreal studies and other careful observations of the emotional patterns of babies show no evidence of the emotion of shame. Evidently it is absent in early life—yet it is common to all older children and adults. The reason why young children have no sense of shame is not clear. Cultural anthropologists (social scientists who study and compare the cultures of different societies) point out that shame-provoking situations vary widely among the different cultures. People are ashamed of the things of which their particular culture disapproves. This evidence would seem to indicate that shame is learned and is basically a fear reaction. Another hypothesis would be that shame is a native emotion which appears as a result of maturation and that only the shame-provoking situations and forms of expression are learned. Thus far psychologists have not adequately tested either hypothesis because of the difficulty of isolating the two factors of maturation and learning. Regardless

of how shame originates, however, the different ways it develops in different cultures indicates the manner in which social experience can complicate emotional behavior.

EMOTIONAL DEVELOPMENT IN CHILDHOOD

The young infant's responses to emotional tension, either pleasant or unpleasant, are usually vigorous and uncontrolled, regardless of the strength of the stimulus. Although his emotional outbursts usually last for only a short time, they are intense to a degree seldom found in later years.

Further differentiation of emotions. Lack of control continues to characterize the emotional responses of early childhood, but the variety of response continues to increase, and a widening number of situations become provocative. The child becomes angered, for example, not only by physical frustrations but also by the increasing number of social restrictions he encounters as his environment expands. Crying is still a common response, but it is replaced in some situations by other methods of protest—shaking the head, saying “no,” disobeying.

Young children are most likely to respond emotionally to tangible events. They are angered by the frustration of their immediate wants and find joy in the immediate and the obvious—their own accomplishments, funny sounds, physical incongruities. Their fears are more often tangible than imaginary and are aroused chiefly by things which seem frightening because they are unfamiliar.

As the child develops the capacity to perceive things more accurately and to remember and anticipate events, he begins responding emotionally to events and situations as *signs* of possible fulfillment or frustration in the future (Hurlock, 1953). This change is accompanied by the appearance of a new emotion—*worry*. The most common sources of worry during later childhood are family and school problems, personal and social adjustment, and health (Pintner and Lev, 1940). Although the child worries about an increasing number of things as he gains experience, he loses many of his previous fears, which experience has taught him were unfounded.

The beginnings of emotional control. During early infancy most of the child's self-centered demands for immediate satisfaction are

usually met. But soon he begins to reach the level of physical and psychological development where he must learn to bear frustration—to give up the complete satisfaction of his own needs and begin meeting the demands of his particular culture. One lesson he learns is that violent, uncontrolled emotional expression is not acceptable. Thus while a growing number of social restrictions increase the child's emotional tensions, they also impose rules on the way he can release them. Fortunately, by sacrificing some of his demands, he is able to gain the positive emotional satisfactions of approval, praise, attention, and affection.

Emotional control is not easily achieved, and outbursts continue to occur with fair frequency during much of childhood. A child often stores up such excesses of energy and emotional tension that some kind of outburst is almost inevitable. It may take the form of boisterous laughter, rough-and-tumble play, or a temper tantrum—depending upon the immediate stimulus and the individual child. On the whole, however, children gain steadily in their ability to express their feelings less directly, often by verbalizing them. Instead of kicking and screaming when he is angry, the older child may instead be sulky, withdrawn, or quarrelsome. The same restraint of expression also becomes characteristic of his pleasant emotions. He laughs less often and less boisterously than when he was younger, but he smiles more often. He becomes reticent about displaying his affection openly but learns new ways to express his love—by seeking out the loved person, for example, and attempting to please him. Emotional control, in other words, is not a matter of suppressing the emotions so much as of finding approved ways to express them.

EMOTIONAL TENSIONS DURING ADOLESCENCE

Adolescence in our culture is a time of heightened emotional tension. Though the explanation for this may rest partly in physical and glandular changes, social factors are probably more important. In our society adolescence brings changed and uncertain status. One psychiatrist has called the years from twelve to eighteen the "not quite" age, because individuals of this age are not quite children, not quite adults, and not quite sure of themselves (Lowrey, 1952).

The adolescent's uncertainty of his social role and of his own feelings gives rise to the common problems experienced at this age—parent-child conflicts, "puppy" love, crushes, and strong peer-groups or "gangs." An important element in each of these behavior patterns is the adolescent's search for ways to express his independence without sacrificing his security. Since his family is usually slow to accept him as "grown up," he leans heavily on others—particularly those of his own age group—for support and approval. At this age nothing is quite so likely to produce worry and depression as the feeling of being unlike others, of being an "odd ball," of being left out of things. Boys and girls who lack a feeling of secure status in their homes are more likely to be influenced strongly by gang beliefs and activities than those who have satisfying family relationships (Crane, 1955).

It is apparent that the social conflicts and uncertainties of adolescence contain the ingredients of emotional stress. One psychologist has described the heightened emotionality of adolescence, particularly of the early and middle teens, in terms of five major characteristics: (1) intensity; (2) lack of control; (3) lack of consistency, or a tendency to shift rapidly between extremes of pleasant and unpleasant emotion; (4) prevalence of moods, or drawn-out emotions; and (5) the growth of sentiments, or emotions with intellectual associations—such as patriotism, family and group loyalty, reverence (Hurlock, 1953).

The intensity of adolescent emotions, of course, differs from that of the infant or young child. Although the response in both cases is often stronger than the stimulus seems to warrant, the responses of the two age groups are otherwise quite different. Perhaps the most significant difference is that the adolescent has learned to verbalize his emotions rather than to express them with a physical response. He has also adopted some fairly stereotyped patterns of response—he mopes, giggles, looks awkward, and "blows off steam" in much the same manner as his contemporaries. And finally, although the adolescent is subject to somewhat unpredictable "ups and downs" of emotion, his emotional reactions tend to last longer than those of a little child—unless they are interrupted by another stimulus which provokes emotion.

One reason why boys and girls of this age experience so many moods is that they tend

to be preoccupied with themselves and with the many new problems peculiar to their age. Thus, they "nourish" their emotions. Another reason is that adolescents, facing adult expectations for the first time, feel inhibited about expressing their emotions. Their old patterns of response no longer seem appropriate, and they have not yet had time to develop satisfactory new ones.

By the time most people reach their late teens, the heightened emotionality of early adolescence has started to taper off. Older adolescents experience some new tensions, of course, as the result of having to think seriously about such major decisions as work and marriage, but most people by this time are well on the way toward achieving emotional maturity.

ADULTHOOD AND EMOTIONAL MATURITY

When the individual is in his late twenties or early thirties, he normally has solved most major problems of adjustment. He has made a good start in his life work and probably has chosen a spouse and started a family. These factors contribute greatly to making adulthood a period of relative emotional calm. Middle age, of course, requires new adjustments—as children grow up and leave home, physical vigor decreases, and the prospect of retirement looms closer. The fact that most people are able to adjust to the problems of middle age successfully is a sign of their emotional maturity.

Emotional control in adulthood. Perhaps because of his greater experience, the mature adult is indifferent to many stimuli that gave rise to childish or adolescent emotionality. He is not angered by minor frustrations, nor are his feelings easily hurt. More important, when his emotions are provoked he is usually able to defer any overt response until an *appropriate time* and then choose an *appropriate manner* of responding (Cole, 1944).

Although society imposes the need for controlling the expression of emotional tensions, the individual is left with the problem of learning how to exercise that control. Some adults never achieve real control and as a result have unsatisfactory social relationships—with their families, at work, with their friends. Others "control" their emotions by bottling them up and refusing to express them at all,

usually with unfortunate results for their physical and mental health. The mature individual, on the other hand, controls his emotions without denying them. By doing what he can to maintain good health, get adequate rest, choose congenial work and surroundings, avoid unnecessary pressures, and develop a sense of humor, he goes a long way toward avoiding unpleasant tensions. He also develops healthy and acceptable outlets for releasing unpleasant emotional tensions—hobbies and varied interests, sports, and manual work are but a few of many possibilities. Such outlets are an important factor in emotional health, for although man can learn to *control the expression* of his emotions, he can never *eliminate* them.

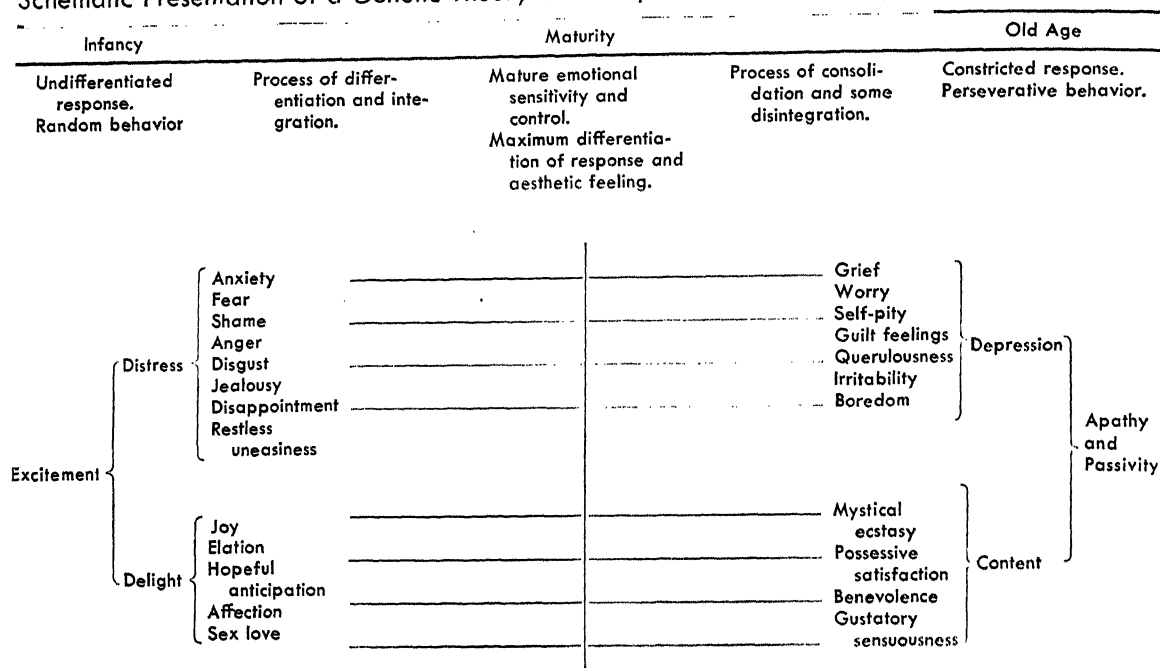
Richness of emotional experience. The emotional behavior of adults is richly varied and usually is channeled more usefully than at any other time of life. The mature individual reaches maximum sensitivity to his environment and is capable of keen esthetic appreciation and other refinements of emotion. Wise adults make the most of their varied capacities for emotional experience by developing varied interests. Instead of devoting themselves exclusively to their children, they pursue sports, hobbies, community activities, and other interests. Thus they are not at a loss when children leave home or when regular business activities cease. Equipped with varied interests, they are prepared to meet the problems of old age.

EMOTIONAL PROBLEMS OF OLD AGE

At best, old age is a time of deprivation. Family relationships change, occupational status is lost, and friends die. Decreased physical vigor forces the elderly person to give up many former pleasures. And all too often financial resources become so limited that they are a cause of active anxiety. With so many frustrations it is little wonder that old people have a reputation for being crotchety.

Along with specific emotional deprivations, most elderly people experience a general lessening of emotional excitability. In many ways this is fortunate, because the elderly person is less disturbed by discomfort and frustrations than a child or young person would be (Banham, 1951). The older person also has the asset of long experience, which enables him

Schematic Presentation of a Genetic Theory of Life-Span Emotional Changes



Adapted from Bonham, 1951

to be better prepared for emergencies and therefore less frightened by them. When he *does* experience a severe emotional shock, however, he often becomes exhausted by it and remains depressed for some time. The young person, on the other hand, recovers from a startling event quickly and with enough surplus energy to pursue other interests, which help him forget the experience more quickly (Hurlock, 1953).

Another characteristic of the emotional life of the aged is rigidity. Elderly people find it hard to adapt to new conditions and tend to respond to new emotional situations with whatever behavior has served them well in the past. Sometimes this works, but often the old pattern of behavior is inadequate in the new situation. The diagram on this page shows how the emotions change throughout life from the undifferentiated response of the infant, through the complex and well-differentiated emotions of the adult, to the constricted response of the aged person.

Undoubtedly you have known many elderly persons who retained their interest in life and were flexible in their reactions. Bertrand Russell, the British philosopher and mathematician who began writing short stories when he was eighty, is exceptional but not unique. Any person who plans ahead and develops as

many interests as possible can do much to avoid the narrowing of life that tends to come with old age. He can enjoy the closing years of life by making the most of his freedom from constant daily responsibilities.

SUMMARY

Emotions can be studied as *conscious experiences*, as external and internal *physical responses*, and as *motives* which direct our behavior toward the objects and people in our environment. The complex physiological changes in emotion are what most clearly distinguish it from other kinds of psychological process.

As motives the emotions share many characteristics with the biological drives, but they are different in at least three important respects: (1) emotions are reactions to symbols or *external stimuli* rather than tissue needs; (2) they depend upon the situation's having *significance to the individual*; and (3) they usually arise in situations where there is *no habitual response*.

The conscious content of emotion can be studied only by examining the subjective re-

ports of various individuals. The external responses of bodily and facial muscles, on the other hand, can be observed directly. Overt emotional behavior usually follows a pattern of *destruction*, typical of anger; *approach*, typical of the pleasant emotions; *retreat*, typical of fear; or *stopping of response*, typical of gloom or grief. Other external indicators of emotion are *vocal expression* and *facial expression*, although these cannot always be interpreted accurately.

The most sensitive and objective method of studying emotion is measurement of the physiological changes controlled by the *autonomic nervous system*. The accelerated activity of the *adrenal medulla* during emotion is responsible for many of the *visceral changes* which together constitute the *emergency reaction*. Besides rendering the individual less sensitive to pain, these internal changes enable a person to exert maximum strength momentarily or to act over a longer period of time than normally. Other physiological indicators of emotion are changes in the *galvanic response* and in the pattern of *brain waves*. During emotional disturbance, the characteristic alpha rhythm of the brain is reduced or blocked altogether.

The complex physiological changes involved in the emergency reaction can actually harm the organism if they continue over an extended period of time—as sometimes happens when an individual is unable to cope with a particular situation. The term *psychosomatic disorder* refers both to the symptoms involved in a persistent emergency reaction and to the actual tissue damage that can result from chronic physiological mobilization.

A useful concept in understanding psychosomatic disorders, developed recently by Selye, is that of the *general-adaptation-syndrome*. According to this theory the body reacts to stress in three major phases: (1) the *alarm reaction*, during which physiological symptoms appear in response to the application of a stress-provoking agent, or stressor; (2) the *stage of resistance*, during which increased activity of the adrenal cortex and anterior

pituitary glands help the organism adjust to stress and cause the original symptoms to disappear; and (3) the *stage of exhaustion*, which occurs when the organism can no longer maintain its resistance to stress. During the period of resistance to one stressor, the organism's ability to resist subsequent stressors is greatly reduced.

The development of our complex emotional behavior is a product both of *maturation* and of *learning*. Early experiments by Watson showed that many emotions which had previously been considered instinctive were really the result of *conditioning*. Through this learning process, previously neutral objects and symbols come to be associated with either pleasant or unpleasant experiences and thus become effective as emotion-provoking stimuli. Watson also demonstrated how conditioned emotional responses often spread to similar objects through the phenomenon of *stimulus generalization*.

More recent investigators have modified and extended Watson's work by pointing out *individual differences* in emotional response, the importance of the *nature of the stimulus* in emotional conditioning, and the role of *maturation* in emotional development. The factor of maturation seems particularly important in the *differentiation* of emotions during infancy. Because of its relationship to level of intelligence and capacity to discriminate, maturation also helps determine the individual's ability to interpret various objects and people in his environment as threatening or rewarding.

The pattern of emotional development from infancy through *emotional maturity* is characterized by increasing *variety* and *richness* of emotional experience and by improved ability to *control* the emotions—that is, to express them in appropriate ways. As the individual approaches *old age*, on the other hand, his emotional responses are characterized by *lessened intensity* and *increased rigidity*. Thus maturation continues throughout life to operate with learning in determining the nature of our emotional behavior.

CHAPTER SEVEN

REACTIONS TO FRUSTRATION

KINDS OF FRUSTRATION

THE DYNAMICS OF FRUSTRATION

DEFENSIVE REACTIONS TO FRUSTRATION

NEUROTIC REACTIONS

PSYCHOTIC REACTIONS



In our study of drives and emotions we have seen how human beings constantly strive toward goals which gratify their complicated biological and psychological needs. Sometimes we reach our goals with relative ease. But what happens when our needs are *frustrated*—that is, when our motives are denied or thwarted by some obstacle which lies between a need and its goal?

Human adjustment is a never-ending process of dealing with frustration. True, serious frustration of our biological drives has become relatively rare in modern civilization, but the complicated frustrations of acquired drives and emotional needs have become even more common than they were in earlier times. In the twentieth century we face business competition, marital problems, social laws and taboos, international tensions, and many other frustrations that are difficult to attack directly. And in our daily living we face one minor frustration after another—broken watches, late trains, fallen cakes, lost papers, absent friends, and so on and on.

How can we adjust to these constant frustrations? Sometimes we can overcome them, but sometimes we must yield to them, and often we must "learn to live with them" year in and year out. More than one person in ten at some point in his life is frustrated to the extent of needing medical and/or psychological help. In this chapter we shall examine some of the many different ways by which we adjust to the frustrating situations—large and small—that confront us all.

KINDS OF FRUSTRATION

The endless array of obstacles that interfere with modern man's complex desires may be classified into three main categories, producing frustrations we can label *environmental*, *personal*, and *conflict*.

ENVIRONMENTAL FRUSTRATION

Our environment is full of obstacles, large and small, that impede our progress. Our physical environment may frustrate us drastically, through earthquakes, tornadoes, famines, or floods. It also provides innumerable petty frustrations—the barking dog that keeps us awake at night, the traffic jam, the uneven sidewalk we stumble on, the post-office pen that won't write, or the rain at the picnic.

More serious for most of us are the obstacles provided by our social environment. Social frustration takes many forms. Formal laws and tacit conventions prevent us from freely expressing many of our impulses. The man who has to work with unpleasant associates, the orphan cared for in the impersonal

atmosphere of an institution, and the Negro living in a prejudiced community all suffer social frustrations.

PERSONAL FRUSTRATION

An individual suffers *personal frustration* when some personal limitation—either real or imagined—prevents him from satisfying his motives or realizing his ambitions. A boy who wants to play football on the school team may be thwarted by his lack of skill. The individual who wants to go to college may be thwarted because he cannot pass the entrance examination. Both physical and psychological barriers may be sources of personal frustration. For example, a boy who really wants to be popular with girls may be reticent about meeting them because he feels that he is unattractive; another may be just as shy because he feels that he lacks social grace.

Personal frustration is frequently complicated by *feelings of inferiority*, which serve to increase the frustration. On a questionnaire

administered to a large group of college students, less than 10 per cent of the respondents reported that they had never experienced inferiority feelings about some aspect of their personal capacities—physical, social, intellectual, or moral (Allport, 1937). But college students as a group actually tend to be *superior* in all of these categories. Why, then, did they feel inferior?

The answer to this peculiar paradox lies in the fact that feelings of inferiority are based not on actual inferiority but rather on one's *level of aspiration*. If an individual's level of success in some activity falls below the level of the goal he has set for himself, he is frustrated. We all should have goals that are a real challenge to us, but unrealistic self-expectations only invite failure and a feeling of inferiority.

CONFLICT FRUSTRATION

When an individual must choose between two motives, each of them strong but each opposing the other, he faces *conflict frustration*. Since our motives may be either positive or negative—either seeking or avoiding—three types of conflict are possible: (1) *conflicting attraction*, (2) *attraction-repulsion*, and (3) *conflicting avoidance* (Lewin, 1935).

Conflicting attraction. When the individual has two desirable but mutually exclusive goals, his conflict is one of conflicting attraction. For example, a child holding a valued toy may see a kitten he wants to pet. In order to take up the kitten, he must put down the toy. At the adult level a young man may want to marry and also to finish his education, when his financial condition will not permit him to do both. Conflicts of this type must usually be resolved by choosing one goal over the other, either excluding one entirely or deciding which to do first. Sometimes, however, it is possible to work out some compromise which will enable you to achieve both goals.

Attraction-repulsion. In attraction-repulsion conflict the individual is attracted to one object and simultaneously repelled by another object in close association with the first. For example, a child may want to pick a water lily in a pond but be afraid to wade out in the water to get it. Or a person may want to safeguard his health by going to the doctor for a physical checkup but fear the possible consequences of such a visit. The closer the individual gets to the attractive object the

more strongly he is repelled by the other one. Attraction-repulsion conflicts usually produce indecision and vacillating behavior before a final decision is reached.

Conflicting avoidance. When the individual seeks to avoid two unpleasant alternatives but cannot directly avoid one without encountering the other, his conflict is one of conflicting avoidance. For example, in taking a particular course you may not want to do all the studying required, but you also do not want to fail the course. Or you may want to avoid working with some person on a committee job and also to avoid offending him by saying so. Conflicts of this type are most often solved by "going out of the field." In the first example, you might drop the course. In the second, you might resign from the committee altogether or volunteer for a different job.

There are both successful and unsuccessful ways of adjusting to any type of frustration. In the following sections we shall examine some of the most common reaction patterns.

THE DYNAMICS OF FRUSTRATION

When any goal-directed activity is blocked, the individual experiences an unpleasant emotional upheaval which continues as long as the need remains unsatisfied. This response to frustration is one of the many conditions which Hans Selye (page 157) has called *stress* (Selye, 1956). Even though the "good sport" may meet defeat with a smile, his loss represents some degree of frustration. And frustration is always accompanied by some amount of stress.

THE MOTIVATIONAL NATURE OF FRUSTRATION

Because frustration and the resulting emotional upheaval are unpleasant, an individual will try to overcome them by direct or indirect attempts to satisfy the thwarted need. Thus the resolution of conflict and the reduction of frustration become extremely important in motivating human behavior.

Dealing with everyday frustrations. We may say that an individual has adequately resolved a frustrating situation when he de-

velops and executes a response which overcomes the obstacle and permits him to reach his goal. To arrive at such a solution he may use trial and error or rational analysis of the situation or both. Sometimes, of course, an attempt to overcome a frustrating obstacle may be impractical. The best course of action then might be to avoid or leave the frustrating circumstances, in order to find a situation where a satisfactory adjustment is possible. The frustration of giving up a goal is often less than that of repeated failure. In most cases, however, good mental health means facing up to frustration and resolving it rather than withdrawing.

Stress may operate on either a conscious or an unconscious level. In fact, the original need and its frustration may both be below the level of consciousness. Yet they will motivate the individual's behavior just as surely as if he were well aware of the whole sequence. In spite of the unpleasant nature of the stress that accompanies frustration, it has real survival value, for it greatly strengthens the individual's motivation to overcome the obstacles he encounters.

Severe frustration. By observing the behavior of combat soldiers during World War II and the Korean War, psychologists were able to gain considerable insight into the effects of one type of severe frustration.

The reactions of a group of prisoners of war who had been subjected to the intensive political indoctrination known as "brainwashing" during the Korean War were particularly interesting. All less than twenty-five years of age, these men had been subjected by their Communist captors to over two years of physical maltreatment—cold, hunger, beatings, death marches, etc.—and also to severe psychological stress, including having to watch their buddies shot to death, being isolated, and being forced to listen to propaganda directed against their whole way of life. In most cases they were belligerent at first but became more and more depressed and apathetic, indulging in fantasies which were made more vivid by the practice of smoking hemp (marijuana). As one expressed it, "At first, when a buddy died, I'd get very upset and not talk to anyone for days. But after it happened so many times, I didn't seem to care—and I wouldn't feel anything."

By threatening harm or nonrepatriation and by stimulating guilt feelings and undermining family and religious devotion, the Chinese Communists extorted "confessions" or "self-criticisms" from many

of the men. A few reacted like children of inconsistent, demanding parents. They did not want to give in to the new authority of the Chinese but were unable to resist it. Thus they showed guilt, confusion, hostility, and continual conflict over what they should do. Some of the others had very strong resistance patterns to authority of any kind and were able to resist the brainwashing. In fact they were largely passed over by the Communists as poor material for conversion. The majority of the men learned to "play it cool," to be cautious and inconspicuous, and to cooperate as little as possible without rousing the active hostility of their captors (Lifton, 1954).

EGO-INVOLVEMENT

Many of our everyday frustrations function only as sources of minor annoyance. Some types of frustration, however, constitute real threats to our fundamental needs. Losing one's job, for instance, can be a source of genuine apprehension: the prospect of unemployment not only means reduced financial ability to satisfy one's biological needs but also may involve feelings of insecurity, lowered self-esteem, and loss of social approval. Any frustration embodying a threat to the individual's self-concept is said to be *ego-involving*.

The problem of protecting the self-concept has always received much attention. In the seventeenth century the Spanish philosopher Gracián wrote satirically in his *Art of Success*:

"He is not a fool who does foolish things, but only he who, having done so, has not the wisdom to



Two pianists, Rudolf Serkin and Claudio Arrau, are shown above listening to playbacks of recordings they have just made. Their physical tension and the absorption evident in their whole manner reveal an extreme and quite natural ego-involvement.

hide them. You should keep secret your desires, and even more so, your defects. All men err—but with this difference: while the wise man may mention what is done, the fool will flaunt his folly. Reputation depends more on discretion than on acts. He who is not chaste must be cautious. The follies of great men—like the eclipses of the greater constellations—are most noticeable. The concealing of follies is an exception to the confidence of friendship: indeed, *one should try to conceal them even from oneself*. Here one may apply another rule of life, which is to learn to forget" (Gracián, 1647; translated in Lockley, 1956. Italics ours.).

Modern psychologists heartily *disagree* with this advice. Many people try to conceal their faults from themselves or to forget unpleasant occurrences, only to be confronted by their difficulties again, disguised so that they are harder to deal with than before. It is only through realistic acceptance of ourselves that we can adequately protect and preserve our self-image. Psychologists and psychiatrists help people face their "follies" and accept themselves as they are.

But we still have the problem of defending the self. Ego-involving frustrations are highly painful and call for immediate and vigorous defensive reactions. Just as we try to ward off a physical blow, so we tend to respond defensively to criticism or ridicule. The complex and varied behavioral devices, or *mechanisms*, which individuals sometimes employ in self-defense will be discussed in the following pages. Since successful adjustment depends on our success in *handling* frustrations rather than on whether or not we have any, it is extremely important for us to examine our own reactions honestly. Only in that way can we recognize and modify the ineffective ones.

DEFENSIVE REACTIONS TO FRUSTRATION

As the individual progresses through life, he builds up an extensive repertoire of psychological defense mechanisms which he uses—unconsciously—to adjust to ego-involving frustrations. Unless used to an extreme degree, defensive behavior may be considered

essentially normal. There is a limit, however, to the usefulness of the various defense mechanisms in reducing frustration. When the individual is overly dependent upon them, they may actually hinder rather than help the process of normal adjustment. Whether their use is healthy or unhealthy depends on how much the individual relies on them, their value in reducing frustration, and (to some extent) their social acceptability. By working out realistic techniques for dealing with everyday frustrations, you can do much to avoid developing too great a dependence upon unconscious defensive behavior.

Even the most common defense mechanisms are psychologically complex and extremely varied. In terms of their general patterns, however, we may classify them in terms of three fundamental types of adjustive behavior: (1) flight or withdrawal reactions; (2) aggressive reactions; and (3) compromise or substitute reactions.

WITHDRAWAL REACTIONS

One basic type of defensive reaction is withdrawing from the frustrating situation. Basically a fear reaction, withdrawal may take the obvious form of actual physical flight or, more commonly, the subtler form of retreating within a "shell" of psychological defenses. In mild forms these psychological withdrawal reactions are important and valuable modes of normal adjustive behavior.

Fantasy. When a person's desires are frustrated by reality, he may retreat into a fantasy world where his thwarted wishes can be satisfied. To create fantasies or daydreams as a temporary escape from the frustrations of reality is a perfectly normal activity, provided it is not carried so far that the individual gives up striving for satisfaction in the real world. There is evidence that daydreaming is a well-nigh universal activity among normal young people.

In the table below are the results of one study of the fantasies of 195 undergraduate and 195 graduate students. The ages of the students ranged from eighteen to fifty, with a median age of twenty-one for the undergraduates and twenty-eight for the graduates. In both groups daydreaming was prevalent—in fact, only 3 per cent reported having had no recent daydreams. Among the most frequent

Per Cent of College Students Reporting Various Types of Daydreams

type	ever				recently			
	undergraduate		graduate		undergraduate		graduate	
	M	W	M	W	M	W	M	W
physical feat	91	60	96	58	30	3	13	2
physical attractiveness	89	95	94	96	34	63	17	56
mental feat	88	92	89	90	48	42	47	61
vocational success	100	98	99	93	81	69	78	64
money or possessions	100	97	94	95	69	66	51	52
display	78	76	90	83	22	16	19	19
saving	89	63	90	66	14	5	14	8
grandeur	67	48	63	39	11	7	6	0
homage	81	72	81	66	16	13	24	18
sexual	97	96	96	89	74	73	63	71
death or destruction	39	44	60	46	9	9	10	9
martyr	70	79	64	62	9	15	10	12
worry	92	89	87	91	45	56	49	50
other types	63	53	52	51	30	20	24	23
repeated daydreams	89	93	83	87	48	51	36	47
median number of types	13	12	13	11	5	5	4	5

fantasies were those of vocational success, money or possessions, and sexual conquests (Shaffer and Shoben, 1956).

The frequency of daydreams is apparently determined by the strength of the motives underlying them in relation to the degree of frustration these motives are suffering. Young children daydream of food more often than teen-agers do, because food (especially sweets) represents one of their greatest sources of satisfaction. Adolescents, in turn, daydream about love more frequently than young children do, because they generally are experiencing considerable frustration of their new-found interest in sexual activity.

Satisfaction may come from actual dreams as well as daydreams—both express unsatisfied desires. Indeed, psychoanalysts maintain that the primary function of nearly all dreams is to fulfill wishes frustrated by reality. Sometimes the fulfillment of a wish is obvious from the surface content of the dream, but often it is accomplished through symbols the dreamer cannot readily interpret. (The psychoanalytic theory of dream analysis is discussed in Chapter 8.) Wish fulfillment is illustrated in the following dream, reported by a college student who stated that he had this same dream quite often. The setting of the dream was a town in California where his parents owned a mine:

"I worked hard in our gold mine, but was getting stronger and wealthier every day. I hadn't shaved for three weeks and my only companion was my

faithful Irish setter. I would go fishing and hunting every day. Once a month I would go into town for food and various other things. As all the other fellows would come into town about that time, we would have a big two-day celebration, and then hit back for the hill." The student had spent every summer that he could remember in the mountains near the mine, hunting and fishing, except the summer preceding his dreams. Summer school kept him at home so that he did not get to go on a single deer hunt or even go fishing, and he missed it very much. As he expressed it, he would "much rather be up there lying around than studying for finals," and his wish was partially gratified in his dream (From the author's files).

Although nearly everyone creates fantasies as temporary relief from frustration, daydreaming becomes abnormal and dangerous when it is too frequent or absorbing.

Nomadism. When someone continually wanders from place to place, always "on the move" even when moves bring no tangible gain, he is called a *nomad*. A nomadic reaction as an attempt to get away from a frustrating situation is seldom a satisfactory mode of adjustment, because the frustration usually comes along. Nomadism is evidenced by frequent moving from town to town, by frequent changing of residence within a community, by frequent divorce, or by excessive changing of occupation. Hundreds of thousands of people, aimlessly seeking contentment, move about "just to be going."

Regression. Sometimes a frustrated individual unconsciously seeks to return to an earlier,



At left is seventeen-year-old Miss S., the girl in Dr. Romano's case, before she found the photograph of herself taken when she was five, shown in the center. At right is her painstaking imitation of that early picture.

more secure period of his life. This is known as *regression*. In regressing, the individual flees from the painful realities and responsibilities of the present to the protected existence of his childhood. He reverts to old habits of adjustment—such as weeping, pouting, or childish emotional displays—which he found to work in the past but which are scarcely adequate for solving adult problems.

"A seventeen-year-old girl [Miss S.] was brought to a psychiatric clinic by her mother with the complaint that for the preceding five months her behavior had become increasingly destructive and irrational. The history revealed that after the patient was about four years old her parents had begun to quarrel violently, making her early environment extremely contentious and unstable. At about this age she first developed various neurotic traits: nail-biting, temper-tantrums, enuresis [bed-wetting] and numerous phobias." She was excessively attached to her father, but when she was seven the mother "obtained legal custody of the girl and moved away with her to a separate home. The patient resented this, quarreled frequently with her mother, became a disciplinary problem at home and at school, and acquired a police record for various delinquencies."

Three years later a brief visit to the father brought on a violent scene between the parents, after which the mother, again contrary to the patient's wishes, took her home. "There the patient refused to attend school and rapidly became sullen, withdrawn, and noncommunicative. During her mother's absence at

work she would throw the house into disorder, destroy clothes her mother had made for her, and throw her mother's effects out of the window. During one of these forays she discovered a photograph of herself at the age of five, which, incidentally, was so poorly lighted and faded that, for one detail, it did not show her eyebrows. Using this as a pattern, she shaved off her own eyebrows, cut her hair to the same baby bob, and began to affect the facial expression and sitting posture of the pictured child. When brought to the hospital her general behavior was correspondingly childish: she was untidy and enuretic, giggled incessantly or spoke in simple monosyllabic sentences, spent most of her time on the floor playing with blocks, or paper dolls, and had to be fed, cleaned, and supervised as though she were an infant. In effect, she appeared to have regressed to a relatively desirable period in life antedating disruptive jealousies and other conflicts; moreover, she acted out this regression in unconsciously determined but strikingly symbolic patterns of eliminating the mother as a rival and regaining the father she had lost in her childhood" (Masserman, 1946; case of Dr. John Romano).

A recent follow-up on this case indicates that Miss S. was soon transferred to another hospital, where she remained from December 1943 until March 1949. Her regression became even more severe after admission, and she reacted with little improvement to various kinds of shock therapy. She finally received a prefrontal lobotomy (see page 222), after which she improved enough that she was sent to her mother's home for a trial visit. The record is meager, but letters from her mother during this period indicate that Miss S. was a quiet, conforming, withdrawn individual. Unfortunately the latest information on the patient indicates that she was hospitalized again in 1953 (From personal correspondence with Dr. Charles Hofling, Dr. Jules Masserman, and Dr. John Romano, 1956).

Although a case of regression as severe as that suffered by Miss S. is very rare, it shows the extremes of behavior to which the unconscious defense mechanisms can occasionally lead an individual. If the patient had received psychotherapy before her illness became so serious, she might have been helped to make a realistic adjustment to life.

Usually regression appears in relatively mild forms and may not even interfere seriously with the individual's adjustive efficiency. The regressive mechanism is often expressed, for example, in the "Old Oaken Bucket" phi-

losophy that "things aren't like they used to be." Another familiar form of mild regression is homesickness: when a person has to face new problems in a new environment and finds adjustment difficult, he often falls back upon thoughts of home, where he could always find sympathetic understanding and help.

Regression can occur at any age. A common problem in households where a new baby has just arrived is that of the jealous three or four-year-old child who reverts to baby talk, bed-wetting, and other outgrown habits in an effort to regain his parents' full attention.

Repression. A particularly important mechanism for meeting many of our daily frustrations is *repression*. Repression is the process of excluding from conscious awareness an undesirable thought, feeling, or memory that causes pain, shame, or guilt. Everyone has had the experience of suddenly realizing, after it is too late, that he has "forgotten" to perform some unpleasant duty. When there is excessive psychological pain in recalling a particular experience, the individual's conscious memory of the event may be blocked entirely, as the following case vividly illustrates:

"A man about forty years old was involved in an automobile accident in which he killed a pedestrian. He professed memory of seeing the man standing by the edge of the road, of seeing another car, and of his own actions controlling his car up to the moment of the impact; but he was unable to remember anything that transpired after that until the injured man was placed in an ambulance. The events occurring in the interim—striking the man, calling the ambulance, and talking with other people—were completely blocked out" (Dorcus and Shaffer, 1950).

Repression and forgetting. Although repression and forgetting are basically similar in that each is a process by which material formerly within consciousness is lost to voluntary recall, they differ in at least two basic and significant respects: (1) the cause of the loss of memory and (2) the completeness of the loss.

Many of our daily experiences are soon forgotten, simply because they are of no use to us and thus are never reviewed. Repression, on the other hand, serves to protect the self from the pain of certain thoughts and memories. Everyone has unconsciously re-

pressed the memory of some social faux pas, some embarrassing incident, something he did though he knew it was wrong.

Loss of memory in repression is usually much more deep-seated than that in ordinary forgetting. Even if a person cannot directly recall forgotten material, he at least can recognize it or can relearn it more rapidly than he could learn new material. But repression is often so complete that the person can neither recognize nor relearn the material even when it is brought to his attention. That is, he actively (though unconsciously) keeps himself from responding to any stimulus which might cause him to "remember" certain painful things. However, when repressed material is brought to consciousness—by hypnosis or some other technique—the recall is usually so complete that the person wonders how he ever could have forgotten it.

Unconscious effects of repression. We all are sometimes influenced by thoughts, memories, or wishes which have been repressed but which nonetheless remain active at an unconscious level. These are likely to spill out in disguised forms of behavior that we cannot explain or control. We are conscious neither of the fact that certain thoughts and impulses have been repressed nor that they are finding indirect expression in some of our actions.

Although repression occurs to some degree in nearly all normal adjustive behavior, it can be severely handicapping when excessive. For one thing, it often forces the individual to rely upon additional defense mechanisms so that he can avoid recognizing the real nature of his conflict and at the same time give indirect expression to his repressed feelings. More significantly, repression eliminates the possibility of the individual's developing more realistic and adequate modes of adjustment. So long as the source of his difficulty is repressed, he can never deal with it effectively. A major goal of much psychotherapy is helping patients recognize and come to realistic terms with their repressed feelings.

Reaction formation. When a person unconsciously represses his socially unacceptable desires and impulses because the very thought of having such impulses is guilt-provoking, he may develop conscious attitudes and overt behavior patterns that actually contradict his real, unconscious wishes. For example, if a person is troubled by sexual desires that he

cannot accept as normal, these desires may be repressed to an unconscious level and be replaced in his consciousness by puritanical attitudes and a desire to crusade vigorously against burlesque shows and suggestive literature. This mechanism, known as *reaction formation*, helps the individual reject his unacceptable impulses.

Usually reaction formation is more than a mere counterbalancing mechanism, for the conscious attitudes which develop are usually highly exaggerated, extreme, and intolerant. In suppressing his real feelings of hostility toward people, for instance, the individual may be "overnice" and irritatingly solicitous. Social crusaders and fanatics who vigorously campaign against minor vices and loose public morals are frequently battling their own unconscious desires. Held under control, reaction formation is of real value in preventing behavior which is undesirable in the eyes both of society and of the individual. But like other defense mechanisms, if used to an extreme degree it can result in behavior which is personally and socially harmful.

AGGRESSIVE REACTIONS

When the individual reacts to frustration by aggression, he attacks either the obstacle blocking him or some substitute for that obstacle. Since attack is aimed at eliminating or overcoming the barriers causing the frustration, aggressiveness would be highly adaptive except that modern man's very existence depends upon his living in social groups in which aggressiveness is carefully curbed. In particular situations, of course, aggression may be a realistic and acceptable mode of adjustment, as when a man shoots an armed burglar who has entered his home. Usually, however, aggression is not a satisfactory technique of adjustment. Temporarily it may serve to reduce the mental or physical tensions which accompany frustration, but in the long run aggressive behavior is likely to meet with social disapproval and punishment, thus creating a new source of frustration.

Displaced aggression. Often an individual directs his hostile feelings toward some object or person other than the one actually causing his frustration. This transfer of hostility is called *displacement*. The reasons for displacing aggression are several. The person may be

afraid to express his hostility directly toward those responsible for his frustration, in which case he is likely to find relief by "blowing off steam" at some innocent but less threatening person. Thus the office clerk who has been refused a raise by his boss may go home and snap irritably at his wife and children. Or he may be afraid to express his anger outwardly at all and so turn his hostility inward, blaming himself for his failure. In still other cases the real source of the frustration is so intangible that it defies direct attack. Then the individual is all but forced to find some substitute object of aggression. The most frequent forms of displaced aggression are scapegoating, "free-floating" anger, and attempted or threatened suicide.

Scapegoating. The clerk who blamed his wife and children for his failure to get a raise was using his family as a *scapegoat*. Sometimes people use inanimate or fictitious objects as their scapegoats and so are able to displace their hostility in a way that brings no harm to others. During the Korean War, for example, many GI's felt considerable resentment at giving up their jobs at home to unknown competitors, who sometimes appropriated their sweethearts as well. They vented much of their hostility on a nonexistent character called "Jody," about whom they composed verses like the following (Shogan, 1954):

"We been eatin' Spam without a break,
While Jody's munchin' on a steak,"

and

"There ain't no use in going back—
Jody's got your Cadillac."

New recruits were taught the song almost immediately. The officers, realizing that men who expressed their complaints in song would have a healthier attitude toward military life, made no objections. The ultimate fate of Jody was expressed thus:

"Ain't no use in feeling blue,
Jody's in the army too."

Displaced aggression is sometimes responsible for such social phenomena as racial and religious prejudice. The relationship between frustration and prejudice is clearly revealed by statistics showing that scapegoating is more prevalent during periods of economic depression, when many human needs are unsatisfied (Hovland and Sears, 1940; Mintz, 1946). The

problem of scapegoating will be discussed in further detail in Chapter 15.

"Free-floating" anger. It sometimes happens that a person develops a chronic reaction pattern of anger. His hostility, rather than being displaced onto a particular scapegoat, becomes generalized or "free-floating," so that he tends to regard even neutral situations as having hostile implications (Thorne, 1953). The intensity of such anger is out of proportion to the stimulus arousing it. The chronic type of "free-floating" anger, often dating back to childhood hostility against the parents, may be expressed in hostility to practically all of a person's acquaintances, making normal friendship impossible. Occasionally severe and prolonged frustration causes blind rage, in which a person goes "berserk" and may even kill whoever happens to be near.

Suicide. Sometimes when an individual is afraid to express his hostility openly, he turns it *inward* upon himself. Active aggression is displaced by feelings of self-accusation, which eventually can lead to attempted suicide or, more commonly, threats of suicide (Shneidman and Farberow, 1956). A person who is contemplating suicide often seems less disturbed outwardly—even though his aggressive feelings may actually be greater—than someone who vigorously attacks his environment.

This was found to be true in a recent study of the personality patterns of mental patients who had threatened or attempted suicide. The entire group showed greater hostility than did the control group, but those who attempted suicide were less hostile verbally, directing their hostility inward and being deeply concerned with thoughts of death. Those who threatened but did not attempt suicide displayed active outbursts of aggression and an agitated type of depression in contrast to the resigned depression displayed by the "attempts" (Farberow, 1950).

Self-directed displacement of aggression is clearly revealed in the following case of a suicidally depressed patient whose hostility toward the environment was turned upon himself.

The patient was a hard-working man who had worked at numerous occupations such as truck driving and farming since leaving school in the sixth grade. Upon admission to the hospital, his

behavior was characterized by excessive worry, irritability, outbursts of temper, and crying spells. He talked of suicide, saying that he was "no good anyway." He had always been very sensitive to his environment, being easily offended and taking disappointments extremely hard. Shortly before entering the hospital, his symptoms had been aggravated by a crop failure.

In the hospital, the patient expressed his feelings that he was a failure, and blamed his frustrations upon personal inadequacy: "I'm blue and all worn out all the time. I have spells when I feel like I could fly into a thousand pieces. I can't make up my mind what to do. I let my wife boss me all the time. The easiest way would be to have a train wreck. I'm a whipped man. I've worked hard all my life, and now I haven't anything" (Hathaway and Meehl, 1951).

This patient's self-esteem was very low. He considered himself "a whipped man." Obviously he felt some hostility against the world for giving him a hard battle, but most of his aggressive feelings had been turned into powerful hatred of himself.

Identification. Often the person who would destroy a threatening object or person does



Identification is very important to a child's development. Besides imitating his father's shaving routine, the boy above will also incorporate many of his personality traits. Later he will identify with other persons he considers important and admirable.

so by a process of *identification*. By this mechanism the frustrated individual incorporates into his own personality structure the achievements or qualities of those who threaten him.

Identification sometimes works constructively. It is a highly important mechanism in child development, for it is the source of many of the child's habits, behavior patterns, and attitudes. During his early years a boy usually tends to identify himself with his father, imitating his father's behavior and assimilating many elements of his personality structure. As his social experiences broaden, he identifies himself to a lesser degree with other individuals. Teachers, athletes, movie stars, and other persons whom he considers important and admirable become the objects of his "hero worship." Much of the complexity of adult personality is attributable to this type of childhood identification.

Just as the child may identify himself with his parents, so may the parents identify themselves with their children. For example, the proud father whose son has just graduated from college may obtain real personal satisfaction in his son's accomplishment, as does the mother who dresses her daughter for her first formal dance. According to Freudian theory parents are thus able to "eliminate" their children as rivals.

Prisoners often attempt to reduce the threat to their existence by becoming "informers" or in other ways cultivating the favor of—and incorporating the characteristics of—the guards whom they hate and fear. This type of identification—sometimes called *introjection*—was often seen among prisoners in German concentration camps during World War II and among prisoners of the Red Chinese during the Korean War.

Projection. Sometimes when a person finds his thoughts intolerable, he not only represses them but also convinces himself unconsciously that *other* people have these thoughts toward *him*. By this mechanism of *projection* the individual is able to direct his aggressive feelings toward others rather than toward himself. An example of projection is the case of the unfaithful husband who accuses his wife of infidelity—actually believing her to be unfaithful in the face of what, to an impartial observer, would be overwhelming evidence to the contrary. Another example is the irritable person who accuses others of being irritable while denying that he is so himself.

Projection also enables a person to blame other people—or even things—for failures that are essentially his own responsibility. After having a fight with someone, people are inclined to say, "He started it," or "He had it coming to him." The student who fails a course may claim that the instructor disliked him. And the golfer who drives his ball into the water hole may throw his club or blame his misfortune on a "dead ball." Such projections protect our feelings of self-esteem.

Controlling aggressiveness. For the protection both of individuals and of society as a whole, aggressiveness must somehow be controlled. There is danger not only in direct aggressions (like murder and assault) and symbolic aggressions (like libel and slander) but also in such noncriminal forms of aggression as overstrict child discipline, nagging, and violent displays of temper. Every day in psychological clinics, aggressive feelings are found to be at the root of many human difficulties in parent-child, husband-wife, and subordinate-superior relationships.

The problem of aggression is usually handled in one of two ways: (1) by punishing the individual for any overt displays of aggression or (2) by allowing him to express his hostility in some controlled manner which does not violate the rights of other people.

Punishment. The most familiar way of dealing with hostility is to squash it by means of taboos on aggressive behavior and by reprisals when the taboos are violated. This is the method of control used in law enforcement and child discipline.

The threat of punishment is often an effective device for controlling some expressions of aggressiveness; stealing, for example, would undoubtedly be much more prevalent in our society if it were not for the fear of being caught and punished. Yet, when the threat of punishment is actually carried out, it is likely to increase aggressiveness rather than reduce it, for punishment itself is usually frustrating. It is not surprising, therefore, that severe punishments tend to increase rather than decrease the crime rate (Wilson, 1931).

It is not *always* true, of course, that meeting aggressiveness with threats and punishment will cause the person to become more overtly aggressive. Severely restrictive training, such as that experienced by the child of extremely dominating parents, can produce a very meek and fearful person as well as a

very hostile one. But even though such a person may try to "bottle up" his hostility within himself, it will still exist as an unconscious emotional undercurrent. This fact has been made especially clear in clinical work with severely inhibited children, who often display startling aggressiveness during treatment. In doll play, for instance, such children may actually destroy dolls which they have identified as the "mother" or the "father." Repressed hostility, if not allowed some mode of expression, can have serious effects on the child's personality and behavior.

Controlled expression. Society has become increasingly aware of the limitations of punishment as a method of preventing aggressive behavior. As a result, greater use has been made of the method of controlled expression, which gives the individual an opportunity to discharge his hostile emotional tensions into socially acceptable and even constructive channels. The basic principle of this method is to give aggressiveness relatively free but harmless expression by allowing the individual a time and place to work off his stressful feelings—either verbally or in vigorous work or play. Controlled expression has proved a valuable kind of therapy for dealing with excessive hostility in children and adults.

A mental hospital in Rotterdam has reported that nearly all aggression has disappeared among the patients since the installation of a sort of dummy which the patients are allowed to punch. It is on a spring and always comes back for more, "demonstrating the senselessness of aggression." Since it is rather vague in shape, patients may regard it as a trunk or a head or even as some kind of animal, and they may draw with chalk on its bluish black surface to heighten the illusion (Tolsma, 1953).

Not everyone need go to such lengths, of course, but even people with relatively few aggressive feelings can benefit greatly from giving them controlled expression. Sports, crafts, hobbies, and household chores are excellent sources of relief from the tensions created by pent-up anger. The hard-playing child who is active in school groups, scouting, Y.M.C.A. programs, or other youth activities is much less likely to display aggressive or delinquent behavior than the child who is not given such opportunities for releasing his tensions.

Controlled expression has also been looked upon as a kind of immunizing procedure. It seems possible that by experiencing small amounts of frustration and learning to deal with them satisfactorily, the individual may build up a capacity to withstand greater amounts—in much the same way that a person builds up immunity to certain diseases by experiencing mild cases of them through vaccination (Rosenszweig, 1938).

The task of controlling aggressiveness is really a twofold one. We not only must help the individual find constructive means of dealing with his aggressive feelings; but, even more important, we must try to *prevent* the initial development of unnecessary hostile and resentful feelings.

COMPROMISE REACTIONS

Usually frustration cannot be adequately reduced by either aggressive or withdrawal reactions. Rather, it is necessary in most instances to work out some compromise when we encounter obstacles. We must partially give in to the threats that our frustrations imply, but without relinquishing entirely the goals they block. This generally means lowering our ambitions or accepting symbolic and substitute goals. For instance, a student who is refused admission to medical school might decide that his best adjustment is to become a dental technician. Although attack or flight often seems the easiest way out of a frustrating situation, we usually realize eventually that in order to live satisfactorily with our frustrations we must learn to compromise with them.

Sublimation and substitution. Direct satisfaction of a particular need is often impossible, either because the goal is physically inaccessible or because the behavior involved in achieving the goal would be painful or guilt-provoking. In such cases the individual may resort to indirect means of obtaining gratification, choosing an alternate goal toward which to direct his energies. Although indirect goals never provide exactly the same satisfaction as original goals, they provide an outlet for the expression of frustrated desires and often afford real satisfactions of their own. Such indirect expression of a need, which allows the person to bear his frustrations, may take the form of either sublimation or substitution.

Sublimation. In sublimating a need which he cannot satisfy directly, the individual accepts some alternate goal which provides a *socially acceptable* outlet of expression. Although the new goal is symbolic of the original one, it can be pursued openly without feelings of guilt. Hostility, for example, can be sublimated through participation in competitive sports, especially those such as football, boxing, and wrestling which involve physical contact. The term *sublimation* usually refers more specifically, however, to indirect expressions of the sexual urge. Artistic activities are often interpreted as sublimations of this sort. Reading and writing romantic prose and verse are other socially acceptable—even socially approved—sublimations of the sexual drive, even though their sexual element is often rather thinly disguised. According to some psychologists and psychiatrists, all forms of work—science and business as well as the fine arts—result from the sublimation of sexual energy. Sexual energy is used here in the Freudian sense, as referring to all instinctive, pleasure-seeking impulses of the organism.

Substitution. Frustrated impulses are sometimes expressed indirectly by the substitution of activities in which the conscious quality of the desire is not fundamentally changed. Unlike the mechanism of sublimation, substitution is likely to involve socially *unacceptable* activity, so that it is often (although not necessarily) accompanied by feelings of self-disapproval, guilt, and inferiority.

Like sublimation, substitution is a common outlet for frustrated sexual impulses. In our culture it often takes the form of masturbation and of undesirable language behavior—telling risqué stories, writing obscene poetry, singing smutty songs.

Compensation and overcompensation. The feelings of inferiority that typically accompany failure in some activity are often counterbalanced by the individual's entering some other sphere of activity in which he can succeed. That is, he "covers up" his felt weaknesses by withdrawing from situations in which they would be evident and turning instead to activities that will bring success and self-approval. Such counterbalancing behavior, employed to protect the self from feelings of inferiority, may involve either compensation or overcompensation.

Compensation. Compensation is an attempt on the part of a person to disguise the presence of a weak or undesirable trait by emphasizing a desirable one. Like sublimation, compensation involves behavior that is socially acceptable and desirable. A person who feels socially inadequate because of physical unattractiveness can compensate by developing a charming manner and learning to be an interesting conversationalist. Such a person is welcomed as a friend and his physical unattractiveness is no longer a great obstacle to social success. Because compensatory behavior is aimed at bringing social approval to the individual, it sometimes results in accomplishments of considerable social value.

Overcompensation. Compensatory activity, like any other defense mechanism, ceases to be of value to the individual when it gets out of control. If the activity that is developed to counterbalance failure or feelings of inferiority becomes too strong, it may produce irrational, extreme, and antisocial behavior. Suppose, for example, that a physically unattractive child is ignored by his schoolmates and generally "left out of things." He may want so desperately to gain recognition that he will try to assert himself in ways that actually alienate his classmates rather than win them over—such as talking too loudly or "showing off." Often he develops such a basic sense of inferiority that ordinary acceptance is not sufficient to relieve it—to feel safe and secure he keeps trying to prove that he is *superior* to others.

In the long run overcompensation is seldom effective in reducing frustration, since the social disapproval incurred by such behavior only tends to increase the individual's sense of failure and inferiority. By carefully analyzing his own feelings, the person who suffers from inadequacy can often come to realize that what he wants most deeply is *not* superiority or competitive success but rather the respect and affection of other people. He comes to recognize that his fundamental goal is that of acceptance—which cannot be reached by proving that he is better than others but rather by forming with them a relationship that is pleasant and mutually helpful.

Intellectualization. Another method of compromising with our problems is to push them into the sphere of the intellect, thus partially

divesting them of personal significance or painful feeling. There are three basic mechanisms of intellectualization: (1) rationalization, or excuse-making; (2) isolation, or the use of "logic-tight compartments"; and (3) undoing, or ritualistic "cleansing" behavior (White, 1956).

Rationalization. Rationalization is an unconscious process of giving false reasons for one's unacceptable behavior in order to preserve self-esteem and social approval. By devising seemingly logical and socially approved explanations for his failures or undesirable acts, an individual is able to justify behavior which would otherwise result in loss of social approval and self-esteem.

Rationalization takes many forms. There is the "sour grapes" attitude, so well told in the old fable of the fox who tried in vain to reach a bunch of grapes hanging over his head and then decided they were "too sour" anyway. There is the jilted lover who suddenly realizes that his former girl friend had certain flaws. And there is the "sweet lemon" philosophy of J. M. Barrie: "Not in doing what you like, but in liking what you do is the secret of happiness."

Although rationalizations represent logically sound trends of thought, they are generally based on false premises and therefore are not a realistic way of dealing with life. Most everyday rationalizations are inconsequential, but if an individual relies too much on this defense mechanism, he may develop habits of thinking unrealistically.

Isolation. People often avoid conflict between two opposed desires or attitudes by keeping them apart in consciousness. Certain ideas are sealed off in mental compartments, as it were, and allowed to function in isolation from conflicting ones. Thus the person never has to choose between them. Such mental compartments are said to be "logic-tight" because they enable the individual to maintain contradictory ideas or attitudes without acknowledging their logical incompatibility.

People with logic-tight compartments think and act inconsistently. The following statement illustrates this type of thinking: "All lawbreakers should be tarred and feathered by law-abiding people."

Undoing. Undoing is a form of mental gymnastics whereby an individual can divest him-

self of painful feelings by making use of a "cleansing" ritual. This mechanism is well illustrated in the following case:

A seventeen-year-old boy had a severe conflict about masturbation. In a talk denouncing this practice his pastor had advised that one should never associate with a boy who masturbated. The patient knew a boy who did so and found it very hard to keep away from him. Whenever he saw him, he felt uneasy. Soon he began turning around and spitting whenever he passed the forbidden boy (Fenichel, 1934).

This little ritual is an example of undoing. By means of it the patient expressed rejection and cleansed himself immediately after making the forbidden contact with the other boy.

NEUROTIC REACTIONS

The difference between a normal reaction and an abnormal reaction is one of degree. As the psychologist thinks of it, "normality" includes a wide range of behavior rather than a single fixed point on a scale. In general the normal personality may be described as one that operates as an organized whole and can deal with reality in a more or less effective manner. The use of defense mechanisms is not in itself a sign of abnormality. Everyone relies upon some of these mechanisms from time to time to enable him to stand up under frustration. A little escape from everyday reality may be beneficial, as long as we can face the facts when necessary.

The abnormal or disorganized personality sees "the facts" differently than a normal person would. A self-confident person might easily handle a situation that would seem overwhelming to anyone convinced of his own inferiority. The severity of frustration, in other words, depends not only upon the objective situation but also upon how the individual person interprets it. This explains why abnormal reactions often develop when there is little in the external environment that would seem to justify them.

When frustration is very great, the individual's usual adjustive responses may be inadequate for dealing with it. His reactions may

then become disorganized and exaggerated; instead of helping him cope with his problems, they may actually interfere with his making an adjustment. We use the term *neurosis* to describe a wide range of abnormal reaction patterns—from those that interfere very little with everyday living to some that are quite seriously incapacitating. The term *psychosis* is reserved for very severe mental disorders, usually characterized by a loss of contact with reality.



At any given moment, about one out of every twenty people in our population is suffering from some mild form of neurosis which lowers his efficiency in coping with the environment. Neurotic symptoms are seldom so severe that the person requires hospitalization.

All too often the term "neurotic" brings to mind a stereotyped image of a person who feels misunderstood or cheated by life, has queer ideas, or is very irritable and tense. Actually neurotics vary so much in their re-



Experimenters at Cornell University, under Dr. Howard S. Liddell, are learning how to cause neuroses in sheep and goats—and by causing them, they hope to find out how to prevent them. The neurosis-building procedure is simple—the animal is subjected day after day to a rigid and unvarying pattern of shocks, separated by equal intervals of time and preceded by ten-second signals. The overhead light dims to signal the approaching shock, which reaches the animal through wires attached to its right foreleg (above, left). Other wires connect his harness to a Selsyn Motor on the ceiling which transmits his movements to equipment in another room, where they are finally recorded on a graph (at left). At first the kid reacts wildly; but finally the inevitable pattern causes him to stand rigidly in the corner, braced for the next shock (above). Although the animal shows no outward signs of agitation, an electrocardiograph indicates that its heart is pounding wildly. At this stage the neurosis is setting in.

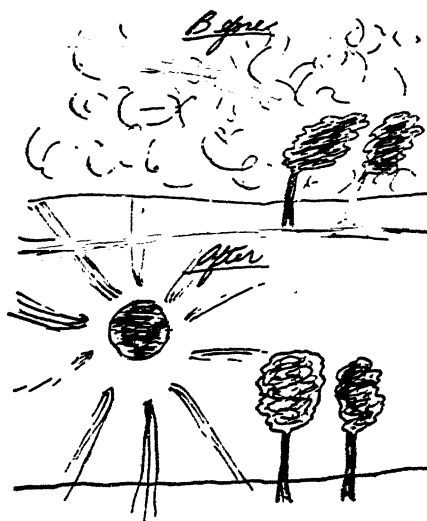
actions that this stereotype, like most other stereotypes, is very inaccurate.

In a recent study 100 college students and 11 professional workers were asked to respond to the items of a widely used personality inventory as though they were neurotic. The same test was also given to 176 patients who had actually been diagnosed as neurotic in clinics or hospitals. The results showed striking differences between the way neurotics really feel and the way college students think they feel. The largest single difference was shown on the item, "If people had not had it in for me I would have been much more successful." Whereas 86 per cent of the female students and 68 per cent of the male students who were pretending to be neurotic marked this item "True," none of the female patients and less than 4 per cent of the male patients marked it "True." A large percentage of the patients stated that they usually expect to succeed in the things they do, whereas not many of the "dissemblers" did. About 80 per cent of the dissemblers marked as "True" the item, "I have one or more bad habits which are so strong that it is no use in fighting against them," whereas less than 15 per cent of the patients did. On the whole the normal individuals believed the neurotics had many more physical complaints, feelings of being misunderstood, sexual conflicts, bizarre ideas, and other abnormalities than they actually possessed, according to their own responses to the test (Gough, 1954).

This study indicates that it is unwise to make hasty generalizations about neurotics. In general, however, it is safe to say that they are relatively disorganized and unhappy individuals whose reaction patterns are inadequate for dealing with many life situations. In the following pages we shall discuss a number of specific neurotic reactions.

ANXIETY NEUROSIS

Typically, neurotic disorders are based primarily upon *anxiety*—that is, generalized feelings of worry and apprehension. The tendency toward anxiety is often acquired early in childhood, when the child may be punished by parents and teachers for trying in socially disapproved ways to satisfy his needs—such as the need for sexual gratification or the need for achievement and status. Having been punished for his way of *expressing* a particular impulse, the person may come to regard the



Stuttering is usually a manifestation of anxiety. In these drawings a stutterer has expressed the acute anxiety he experiences immediately before a moment of stuttering and the calmness which follows it.

impulse itself as dangerous and to feel anxious whenever he experiences it. Thus anxiety has much in common with ordinary fear, except that it is attached primarily to one's own impulses rather than to an external danger (Shoben, 1955).

When anxiety-provoking impulses arise, they are often repressed. This provides temporary relief, but it means that the individual can no longer understand his true feelings or identify the object of his anxiety. His fear is "free-floating"—he is afraid but does not know what he fears. When such fear constitutes the patient's principal complaint, his condition is called an *anxiety neurosis*.

Such a neurosis is usually complicated by the presence of guilt feelings. In his blind search for relief the individual may pursue first one goal and then another, never succeeding. Because of this he often is regarded as irresponsible and immature, and he comes to feel that he is falling short of accepted standards of adult behavior. To hide his painful inadequacy he may resort to deceiving others—and, if possible, himself. This constant deception intensifies his guilt feelings. His anxiety in turn is intensified, and he is caught in a tightening spiral of neurotic difficulty.

The individual with an anxiety neurosis cannot consciously acknowledge the true

source of his fear because it causes him so much pain or guilt. But like all repressed tendencies, it remains active at an unconscious level, expressing itself not only in feelings of calamitous foreboding but also in sudden physical symptoms such as palpitation of the heart and great difficulty in breathing.

The case of Keith S. illustrates a severe anxiety reaction:

"Keith S., male, 30, married. Apprehensive and fearful, tormented by feeling that something dreadful is going to happen. He repeats, 'I'm afraid, I'm afraid of something happening and I don't know just what.' He is afraid to undertake anything new for fear that something terrible will happen. Patient is tense, irritable, restless; complains of headaches and excessive sweating, appetite poor, forces himself to eat; has difficulty in going to sleep. Frequent dreams of falling or being cornered in small hallway without doors or windows" (Thorpe and Katz, 1948).

In this particular case the patient's symptoms were attributed to deep feelings of inferiority and insecurity which could be traced to early childhood experiences in his home and school. Although the patient was still capable of supporting himself and his family, his neurotic reactions clearly lowered his personal initiative and social effectiveness, besides making him miserable.

EVASION OF GROWTH

The element of conflict is predominant in neurosis. The neurotic tends to think of himself as inadequate and unworthy of love or praise. According to this assumption, self-fulfillment is impossible. Yet, like the normal person, the neurotic has a strong urge to grow and to fulfill his potentialities in spite of hopeless obstacles (Angyal, 1953). He may try to evade this conflict between his basic sense of inadequacy and his urge toward growth by *vicarious living*. That is, he may repress his own individuality and act like some admired person or like a stereotyped cultural ideal. As he does this he comes to feel more and more empty. To fill this inner vacuum he overdramatizes every incident of life, wringing the last drop of emotion out of the most trivial events. Or he may form an intense attachment to a mate, child, parent, or hero.

Another way of evading the urge to grow is by *noncommitment*. The individual becomes physically mature but never does more than go through the motions of adult life, much as he did in childhood games of "let's pretend." He never commits himself whole-heartedly to a belief, a vocation, or a marriage partner.

An example is the case of a man who finally married at the age of thirty-seven with the understanding that his wife should continue to live with her parents temporarily, while he kept a room in his family's apartment. He would stay with his wife for a few days and then spend about the same length of time at his own room. He tentatively separated from his wife several times, but whenever she threatened to get a divorce, he would return and be an ardent lover for a time. Once he went so far as to rent an apartment for the two of them, but then almost immediately he became cold and indifferent to his wife. He kept demonstrating his "freedom" by eating alone, sleeping on top of the blanket, or actually going outside and sleeping in the car. As it happened, his wife was called away for an extended visit, and he resolved not to write to her, hoping that she would break off the marriage. Upon her return she calmly announced that she was going to divorce him, whereupon he immediately felt strong affection welling up in him again. They had a week of happiness, then fell back into their previous unsatisfactory relationship (Angyal, 1953).

Such vicious circles, so characteristic of the neurotic, are seldom interrupted without extended therapy.

PHOBIAS

Frequently the "free-floating" fear of the neurotic becomes attached to some object in the environment, resulting in irrational fears known as *phobias*. This process of displacing fear onto some environmental object is similar to that by which repressed hostilities may be transferred to scapegoats (see page 178). Phobias may cause intense panic, as in the case of people who cannot bear to be closed up in a small room or to be on a high cliff or tall building. Or phobias may be expressed as extreme distaste, as in the case of Jane.

Jane, a rather unattractive girl of fifteen, disliked all hands, primarily women's hands. Sometimes the sight of hands "filled her with horror," particularly

pretty, well-cared-for hands. She herself had short fingers and never had her nails manicured. She felt "nervous" and disgusted, if not actually nauseated, at seeing a woman display her hands prominently. To Jane this was "almost indecent." Since she was interested in art, the therapist asked her to make some drawings of hands. She did so, producing horrible hands, either fat and swollen or thin with claws or talons. Often one or two fingers had been amputated by erasures. When the therapist asked her, "Jane, whose hands are these?" she replied hesitatingly, "At first, I didn't know; now I know they are Mother's." Her mother had beautiful hands and was a bit vain about her long, tapering fingers. Though Jane was outwardly on good terms with her mother, she felt a great deal of hostility underneath. This could be traced to the fact that the mother had divorced Jane's father when Jane was four years old and married another man a year later. Jane disliked her stepfather intensely, although he had always been kind to her. As Jane's treatment progressed and the therapist aided her in channeling her hostility into helpful outlets, her drawings of hands changed. By the time she became well adjusted again, she was drawing quite nice-looking hands (Strecker, 1952).

Occasionally a child develops what is known as "school phobia," fearing and hating school to the point where he absolutely refuses to go. The real trouble in these cases is usually at home, but it is too painful for the child to express his fear and hostility there, so he uses the school as a convenient substitute (Suttenfield, 1954). In young children a school phobia may be caused by parental overprotection, rejection, or favoritism shown to a brother or sister. In the case of adolescents with school phobia, these factors may also be the cause, though more often the fear is connected with the attitude of schoolmates or with the appearance of sex urges.

OBSESSIVE-COMPULSIVE REACTIONS

Repressed desires and guilt feelings frequently lead to another type of abnormal behavior pattern known as an *obsessive-compulsive reaction*. Actually obsessions and compulsions are separate types of reactions that may occur quite independently of each other, but they occur together so often that they are generally considered as two separate aspects of a single behavior pattern.

Obsessions. An *obsession* is a persistent and irrational idea, usually unpleasant, that comes into consciousness inappropriately and cannot be banished voluntarily. Almost everyone has some sort of mild obsessional experience, such as the mental intrusion of such petty worries as "Did I really lock the door?" or "Did I turn off the stove?" Having a tune "run through one's head" is another common mild obsession.

A recent study indicates that this phenomenon is frequent among persons under stress. Seven employed adults and three college students normally adjusted but struggling with such difficult problems (marital discord, vocational indecision, etc.) that they had consulted a psychologist, were asked to report any tunes they had noticed running through their heads. All reported that a tune had been bothering them, but only one reported more than one tune. This was a sixty-year-old school teacher with financial worries, who had suffered from a different tune on each of four days, all nonsensical songs that he did not like. In fact nonsensical lyrics were characteristic of the songs reported, which included, "Yes, We Have No Bananas," "Pistol Packin' Mama," and "I Tawt I Taw A Puddy Tat." The one exception was "Nearer My God to Thee." The individuals were irritated by the presence of these tunes and were unable to drive them away. The songs undoubtedly served temporarily to distract them from their more severe problems. It also seemed that the obsessive tunes were a form of partial regression, for the individuals reported that they had first heard the songs at a happy time—several on a date or a trip, one on a honeymoon, and one during his escape from Germany as a refugee.

In contrast to this group of persons suffering from stress, a psychology class of 307 students reported on tunes which had stuck in their minds within the preceding two weeks. Only eleven of them reported the presence of recurring tunes, nearly all of which were currently popular songs. Most of them regarded the inner music as rather pleasant and had no desire to get rid of it. Only one student reported the presence of a tune as being irritating. He was unable to get rid of a phrase from "Macnamara's Band"—"The drums go bang and the cymbals clang, and the horns they blaze away." It may well be that he was suffering from stress, unknown to the experimenter (Berg, 1953).

Though mild obsessions such as persistent tunes can be quite irritating, true neurotic

obsessions are much more insistent and so disturbing that they interfere with the individual's adjustive efficiency. Often they center about morbid thoughts of death or suicide or continuous fantasies of committing murder in some brutal fashion. The severely obsessed patient may repeat to himself hundreds of times a day such strange statements as "The kiss of death is sweet" or "Sex is Satan." Extreme obsessional reactions can be almost completely disabling—the patient may be so overwhelmed by his recurrent obsession that he finds it almost impossible to concentrate on any other thoughts. Because of their generally unpleasant character, obsessions tend to aggravate rather than alleviate feelings of stress and are thus capable of leading to even less healthy reaction patterns.

Compulsions. Because they are so insistent, obsessions commonly lead to compulsions—bizarre and incomprehensible actions which have no observable value. The individual himself does not understand them but nonetheless feels an uncomfortable and compelling urge to express them. The person may sometimes carry out the compulsive acts despite inevitable and serious injury to himself or others.

Compulsions are usually symbolic—that is, the patient resorts to the compulsive reaction as an indirect way of resolving some anxiety or repressed desire. Most commonly compulsions take the form of "rituals," or extreme and detailed preoccupation with minor, everyday tasks. For example, guilt feelings may lead to frequent, compulsive hand-washing in a symbolic attempt to "wash away" the guilt.

A. B. was a successful businessman of forty-five who had a compulsion for "clean, healthy living." This desire was expressed in such wholesome activities as daily exercise, but it also had a secretive, ritualistic aspect. A. B. often took as many as fifteen baths a day, counting hasty sponge baths and alcohol rubs. He usually found an explanation, saying, "Got myself pretty sweaty today," or, "Messing around the warehouse. Grimy place. Dust and dirt of centuries." In taking a drink of water he furtively rinsed out his mouth. In his endless ritual before going to bed he made liberal use of alcohol and Listerine as well as soap and water. He carefully scrutinized the bedsheets, applying a few drops of Listerine to any place that "didn't look quite clean." He reported that he once

worked vigorously for several minutes on a "spot" on the sheet, only to discover that it was a shadow cast by the edge of the bedlamp. Fortunately A. B. realized that his behavior was illogical and fantastic and even showed a sense of humor about it, but he was unable to change it until its deeper causes were brought to light.

When A. B. was eight years old, his older brother, whom A. B. already feared and disliked, discovered him in the act of masturbation. The brother made a disagreeable scene, calling A. B. "filthy," "dirty," etc. and threatening to expose him to the family. He made A. B. get down on his knees and swear never to do it again and promise to lead a "clean, healthy life." The brother terrorized A. B. repeatedly about the occurrence during the next two years. When his brother went away to college, A. B. managed to "forget" the experience. That is, he repressed it, but his anxiety later took the form of compulsion for cleanliness. He also became afraid of his little daughter and indeed was ill-at-ease with all children because he felt they could see through him. With the aid of psychiatric treatment A. B. was able to overcome his compulsion and achieve happiness (Strecker, 1952).

HYSTERIA

Although seldom observed in modern clinics, one of the most intriguing neurotic reactions to excessive stress is *hysteria*—the appearance of physical symptoms that have no organic origin. Indeed, many hysterical symptoms are completely incompatible with medical fact. For instance, in certain types of hysterical anesthesia (loss of sensitivity to touch or pain), areas of the body are affected which definitely do not correspond with the actual arrangement of the neural pathways. In other cases, however, a physician may have great difficulty in telling whether the patient is suffering from an organic ailment or a hysterical one.

Hysteria is often described as a *conversion reaction* to stress—that is, the patient's psychological distress is "converted" into bodily disturbances. It is important to remember that conversion involves no actual biological change. This is clearly demonstrated by the fact that when the individual is asleep or under hypnosis his hysterical symptoms generally disappear. For instance, a patient who suffers from hysterical paralysis may be entirely incapable of moving his legs, but under

hypnosis he may be made to arise from his bed and walk across the room. Moreover, hysterical symptoms may come and go or even appear at different times in different areas of the body; the patient who is hysterically "blind" in his right eye on one day might unconsciously shift his ailment to the left eye on the next day. The disappearance of hysterical symptoms is not necessarily a sign that the psychological stress has also disappeared, and an effort should be made to uncover its underlying cause.

The individual who displays hysterical symptoms is generally quite unaware that they are in disagreement with medical fact. Historically the incidence of hysteria has shown a marked decrease during the past few decades as the public has gained increasing medical knowledge about organic disorders. It is more than mere coincidence that modern examples of dramatic "faith cures" of individuals who have been "struck" blind or lame are relatively rare as compared with their incidence a century ago. The cases of hysteria today are most frequently observed among children and among adults whose intellectual level is somewhat lower than that of neurotics in general.

NEURASTHENIA

Closely related to hysteria, but generally less severe in the nature of the specific symptoms displayed, is another type of conversion reaction called *neurasthenia*. The individual suffering from neurasthenia feels tired all the time and suffers from unpleasant physical sensations such as mysterious "shooting pains," ringing in the ears, and palpitation of the heart. These physical symptoms result from long-continued emotional frustration that drains the person's energy and causes him to feel tired and vaguely unwell. He blames these symptoms for his failure to get satisfaction from life, although both his symptoms and his lack of satisfaction are really caused by his emotional frustration.

Neurasthenia is often difficult to diagnose because the symptoms are less specific than those occurring in hysteria—the patient just feels run down, worn out, and fatigued all over. The "nervous housewife" or the chronically exhausted businessman is frequently the neurasthenic type. Since such symptoms can

also develop from purely physical causes, it is important for treatment to determine whether a given case is actually neurasthenia or a physical ailment. If it is physical, rest or medical treatment is indicated; but if it is neurasthenia, the patient should be encouraged not to rest but to try to achieve real satisfaction in his emotional life and social activity.

HYPOCHONDRIA

Neurotic individuals frequently show an extreme concern about their health and physical condition, dwelling morbidly upon every minor bodily sensation as a possible sign of some dread organic disorder. Such a preoccupation with the body's activities is the main sign of *hypochondria*. If his stomach "growls," the hypochondriac is convinced that he has an ulcer; if he develops a slight cough, he is sure that it is tuberculosis.

Some hypochondriacs are anxious and depressed. They frequent clinics and consult numerous physicians, seeking examinations for suspected cancers, tumors, and other diseases. They are greedy readers of popular medical literature and engage in orgies of self-pity, self-diagnosis, and self-treatment. Other hypochondriacs "enjoy poor health." They take an exaggerated interest in their bodily functions, delighting in recounting details of past operations and describing their "symptoms" at great length to anyone who will listen.

DISSOCIATIVE REACTIONS

Occasionally certain aspects of reality are so painful that the individual represses entire episodes of his life from consciousness. This type of extreme repression is called dissociation. Dissociative reactions may take several related forms, including *amnesia*, *fugue*, and *multiple personality*. These vary in the amount of repression involved.

Amnesia. Loss of memory—especially inability to recall past personal experiences—is termed *amnesia*. The amnesic individual may be entirely unable to remember such simple facts about his personal life as his name and address. Amnesia may result either from organic causes (such as head injuries or diseases of the nervous system) or from purely psychological causes. If the loss of memory is due to organic causes, it is usually

permanent except in some cases of head injury; but if it is a result of repression, the "forgotten" material remains active at an unconscious level and can be elicited under hypnosis or, eventually, through psychotherapy. The following case shows the amnesic reaction of an unstable girl to a frustrating and painful situation:

"Miss B. Q., aged seventeen years, was brought to the clinic in a complete state of amnesia. She was found at a church, in a disheveled state, and could not tell who she was. She spoke coherently, but did not know her name, her address, who her relatives were, how old she was, where she went to school, or any other fact about her past life. Her mental processes were otherwise intact, and she could read, write, and discuss specific problems intelligently.

"Under hypnosis, the essential history of her past was brought to light. She and her sister lived with their widowed father. He was a domineering, sadistic person who demanded implicit obedience and exact accounting of the household budget. On the day the amnesia developed, the patient was given the money for rent, and when she arrived at the agency discovered the money had been lost. The fear and panic that seized her was so great that rather than go back and face certain and severe punishment—she 'forgot' all about herself" (Kraines, 1943).

As this case illustrates, the nature of the memory loss in psychological amnesia is selective. The patient, escaping from herself, was unable to recall the simplest facts concerning her personal history; yet her general intelligence and memory for impersonal facts and skills (such as reading and writing) remained unimpaired.

Fugue. Amnesia, a form of psychological flight, is sometimes accompanied by actual physical flight in which a person wanders off for days or even weeks and suddenly "wakes up" in some strange place, completely unaware as to how he got there. Such episodes are called *fugues* from the Latin word meaning "to flee"). During the fugue the individual displays amnesia for his past life; after the fugue he regains normal memory of his past, except for his activities during the interlude. When placed under hypnosis, however, he may be able to piece together what has happened, as in the following case:

For four years after World War II the patient had suffered from severe anxiety attacks, nightmares, and amnesic fugue episodes lasting from a few hours to several days. During the amnesic periods he felt free not only of his fears but also from ordinary social inhibitions—once in a railway station he gave away his watch and threw his money into the air to be picked up by others. He was unable to hold a job, lost many friends, and altogether was so miserable that he said, "The boys that got bumped off overseas were luckier than guys like me, that's for sure." Shortly after the beginning of therapy, he reported to the therapist one Monday morning that he had left the hospital Friday afternoon on a week end pass but did not believe he had reached home. He had no recollection of the events of the week end. He had started out with ten dollars, but on Monday he had fifty-five and could not imagine how he had obtained the additional money. He told the therapist, "I don't think I'd rob anybody. I know I sometimes gamble in these spells, but I always lose. I could have written checks, but if I did there is no money in the bank to cover them." Weeping, he added, "I'm telling you, Doc, I've had about all I can take. This kind of suffering is more than I can stand."

When the patient was hypnotized he was able to recall that he had seen a friend who had been on board the same destroyer with him during the war. He had started across the street to talk to his friend, had seen flashes of fire, and had shifted to his altered or fugue state. In this altered state he had played the quarter machine and written checks for a total of ninety-five dollars. That night he had had nightmares. When the therapist asked what his real fear was in these dreams, he gasped out "Fire, fire . . . fire." About noon on Sunday, while drinking coffee in a restaurant, he had returned to his normal state and suffered tension and depression for several hours. This episode marked the first time that he felt there was hope for him. The fact that therapy had enabled him to recall writing the checks so that he could put funds into the bank to cover them was very encouraging to him.

This man's illness was the result of extreme stress during World War II. He had to remain on the same destroyer while four successive crews were transferred or replaced. He witnessed many casualties during this period. His first amnesic episode occurred after a near miss of a bomb, during which he received a severe blow on the head when he was thrown against a gun mount. For the preceding four weeks he had been on almost constant duty,

with very little sleep. Three weeks later he passed beneath a battery of five-inch guns just as they were fired unexpectedly. He was surrounded by fire intense enough to burn off all exposed hair and was dazed for several hours. All his later amnesic episodes were preceded by seeing flashes of fire. It was the therapist's opinion that his temporary escapes from the realities of combat through fugues were all that saved him from developing serious mental illness from the prolonged stress he was subjected to.

After the patient had gained some intellectual insight into his fear of fire and its relation to his recurring fugues, the therapist decided to enable him to experience emotionally the similarity between the way he had felt at the time of the bomb blast and the way he felt prior to a fugue episode. To do this, two hypnotic trances were employed. In the first the patient received posthypnotic instructions that, at a signal of three taps on the desk, he would experience the feelings he always experienced immediately before a blackout but that the feelings would cease at a second tapping signal. He was specifically instructed that a blackout would not occur. After the patient had been awakened and had duly experienced the preblackout feelings, he was placed in a second trance. He was instructed to experience, when the same tapping signal was given, the feelings he had had when the bomb had hit. This he did. In both instances it was necessary to repeat the relieving signal several times in order to cause the feelings to cease, but no blackout occurred. In this way the patient was able to see how similar the two sets of feelings were, except that the blast shock experience was more intense. Several hours later a second session was held in which the patient fully discussed the meanings of these experiences with the therapist. That night he had vivid dreams in which he relived all his major war experiences. But, in contrast to his former nightmares, these dreams did not make him feel afraid. From this point on he suffered less anxiety and few nightmares. He was soon able to return home and began to enjoy his former friends.

Nearly three years later the therapist visited the former patient and found him well adjusted. He had a good income from a small apartment house which he had redecorated himself. He had also built and was renting a one-story family dwelling and had realistic plans for improving his rental units. Since he had seen the therapist he had had only two fugue episodes, during the stress of an unfortunate relationship with a woman who tried to extort funds from him. In one of these fugues he took the

role of a lawyer and successfully defended a client in court. Just as the client was about to pay him, he "came to." Realizing what must have happened, he excused himself to make a telephone call and did not return. On the other occasion he represented himself as a country doctor and made a successful emergency delivery of a baby. His versatility in fugues could at least partly be accounted for by the fact that before the war he had wanted to become either a lawyer or a doctor but was unable to afford either course of study. Since this man was no longer troubled by battle dreams or anxiety and the two fugues were connected with an unusual type of stress, it seemed unlikely that he would suffer any more such episodes. On the whole he was relaxed and contented. As he expressed it, "I don't believe I'm ever going to need one of these spells again" (Collier, 1953).

Multiple personality. In its most extreme form, dissociation leads to the much publicized but actually very rare reaction known as multiple personality. In this type of reaction the individual may develop two (or sometimes more) distinct personalities which alternate in consciousness, each taking over conscious control of the person for varying periods of time. Each part of the multiple personality is based on sets of motives which are in conflict with the motives contained in other parts. These conflicting sets of motives originally existed simultaneously in the individual but were so incompatible—and yet all so insistent—that the person was able to satisfy them all only by repressing consciousness of one set while temporarily gratifying another set.

Because multiple personalities represent conflicting sets of motives, the individual's behavior is usually of the "Dr. Jekyll and Mr. Hyde" variety. If one part of a dual personality is selfish, the other is generous to a fault; if one is quiet and obedient, the other is violently aggressive. Thus the individual may be, at different times, two entirely different people—so completely so that his two personalities even go by different names. Usually, though not always, each personality is completely unaware of the other. In some cases one personality may be completely aware of the thoughts and actions of the other but not vice versa.

Students frequently make the error of confusing such cases of multiple personality with

so-called "split personality," technically known as *schizophrenia* (page 199). Entirely different from multiple personality, schizophrenia is the most common of the psychotic disorders. The term "split personality" does not mean that the personality is split into conflicting parts but that the personality has been "split off" from reality, which is the principal characteristic of a psychosis. Multiple personality, on the other hand, is a neurosis in which the conscious part of the personality is in contact with the real world, although reacting to it neurotically.

This dramatic form of reaction is illustrated by the case of Eve White, a twenty-five-year-old woman who sought therapy because of severe, blinding headaches, often followed by "blackouts" (Thigpen and Cleckley, 1954, 1957).

Eve had been having serious marital conflicts and was separated from her husband. Her little girl, aged four, lived with her grandparents in a village while Eve was forced, for financial reasons, to work in a city a hundred miles away from the child. Grief at being separated from her daughter and fear that the child would come to regard her as a stranger added to Eve's difficulties.

The first indication that Eve's case might be more complex than numerous others with similar headaches came when the therapist received the letter reproduced on page 193. He could easily identify the unsigned letter as coming from Eve by the handwriting in which most of the letter was written. But he was at a loss to account for the note in different handwriting at the bottom. Had this been added and the letter mailed by someone as a prank? When questioned, Eve denied sending the letter. She remembered having started a letter to the therapist but believed she had destroyed it before it was finished. During this interview she showed great agitation, in contrast to her usual calm, self-controlled behavior. She startled the therapist by telling him that she had recently been hearing voices addressing her, though this phenomenon was completely inconsistent with her other symptoms. As the therapist was hesitating, trying to think of a suitable reply, a peculiar expression came to Eve White's countenance. She put both hands to her head for a moment, and when she dropped them again, she smiled and said in a sparkling voice, "Hi there, Doc!" Her whole demeanor became reckless and carefree, in contrast to Mrs. White's usual demure, restrained

appearance. The newcomer crossed her legs provocatively and began speaking casually of Eve White's problems, always using "she" or "her" instead of "I." She gave her own name as "Eve Black." Her voice, gestures, mannerisms and dress (when she was "out" for extended periods of time) all differed markedly from those of Eve White, making it obvious that she was a separate personality. The differences in personality traits are summarized in the table on page 194.

In this and numerous subsequent sessions much information was gained from Eve Black. At first the therapist had to hypnotize Eve White in order to get Eve Black to appear, but later it was sufficient to ask either of the two personalities to step aside so that the other might appear. Far from being a recent arrival, Eve Black had existed since Eve White's early childhood, when she occasionally took over and indulged in some forbidden pleasure, leaving the other Eve to suffer the consequences. The latter's sincere denials only increased her punishment, since they were obvious lies in the judgment of her parents. This habit of mischief-making continued in adult life, though no crime or serious misbehavior occurred. Eve Black once remarked, winking at the therapist, "When I go out and get drunk, she wakes up with the hangover. She wonders what in the hell's made her so sick."

Though Eve White had no knowledge of Eve Black's existence until the therapist told her and had no memory of what occurred during Eve Black's periods of control, the latter was somehow able to maintain awareness of all Eve White's actions and feelings. However, she did not regard them as her own. Instead she felt that Eve White's distress over her failing marriage was silly and her devotion to her little girl was "something pretty corny." By thinking very hard about an event, Eve Black would cause Eve White to cease to remember it altogether. Though she could always disappear at will, Eve Black could not always take control when she wanted to. Her unsuccessful attempts to "come out" caused Eve White's headaches and the voices she heard.

After about eight months of treatment Eve White seemed to be making a much better adjustment in many ways, when suddenly the headaches and blackouts became more severe. This time Eve Black denied any part in causing them. One day when the therapist was discussing with Eve White a painful injury she had sustained in early childhood, her eyes closed and she remained in a sort of trance for about two minutes. Then her eyes opened, she stared about the room in a bewildered

fashion, and in a new, rather husky voice asked the therapist, "Who are you?" Obviously, a third personality had appeared.

This one, Jane, was more mature and more capable than the retiring Eve White and had a much more vivid personality. She remained conscious whenever either of the two Eves was in control, but for a long time she had no memory of her past. She made a genuine effort to help Eve White. Although she did not regard Eve's little girl as her own, she felt warm compassion toward her and soon came to love her.

Electroencephalograms (see page 154) taken of Jane and Eve White were both normal and very similar; Eve Black's was classified as borderline normal. Personality tests measuring the three women's basic attitudes toward such fundamental concepts as "child," "my job," "sex," "fraud," and others showed that Eve White had an essentially normal outlook on life but an unsatisfactory concept of herself (Osgood and Luria, 1954). Eve Black had made a violent adjustment in which she perceived herself as perfect, but in doing so she had acquired a highly distorted outlook on life. Jane had the most satisfactory pattern, for she had wholesome attitudes both toward herself and toward cultural values.

As time went on, Jane came to be in control most of the time. Her problem was made all the more pressing by the fact that she fell in love but did not want to marry until she could be sure of being "in existence" all the time. (As Eve White, she had obtained a divorce from her former husband.)

Meanwhile the two Eves provided a store of information about past events. For one thing, Eve White had experienced a strong feeling of rejection by her parents, especially after the birth of her twin sisters when she was six years old. Poverty and the strict discipline of her mother may also have contributed to childhood unhappiness. The therapist sought, however, for some shocking event which had brought about the actual split in the personality of the disturbed little girl. In a dramatic moment, the climax of therapy, Jane provided the missing incident.

When the therapist called forth Eve White on that day she had declared that she was satisfied that Jane would make a good mother for her little girl and was therefore willing to go. When Eve

In retrospect, the letter at right was the first intimation that Eve White was an unusual case. The dramatic and unexpected revelation of the second personality followed shortly after it was written.

Dear Doctor,

Remembering my visit to Sue brought me a great deal of relief, to begin with.

Just being able to recall the trip seemed enough, but now that I've had time to think about it and all that occurred, it's more painful than I ever thought possible.

How can I be sure that I remember all that happened, even now? How

can I know that it won't happen again? I wonder if I'll ever be sure of anything again.

While I was there with you it seemed different. Somehow it didn't matter so much, so have forgotten; but now it does matter. I know it's something that doesn't happen so.

I can't even recall color schemes and I know that would probably be the first thing I'd notice. My head hurts right

on top - it has ever since the day I was down there to see you - I think it must be my eyes - I see little red & green specks - and I'm covered with some kind of rash.

So please be quite sure and don't let me have patience with her who has such an innocent and my self-control

Personality Traits of Eve White and Eve Black

Eve White

Demure, retiring, in some respects almost saintly

Face: quiet sweetness; in repose, contained sadness

Posture: tendency to slump; careful, dignified movements

Voice: softly modulated, specifically feminine restraint

Dress: simple, neat, conservative, inconspicuously attractive

No allergy to nylon

Almost all admire and feel affection for her; does not provoke envy; reads poetry and likes to write verse; industrious and able worker, housekeeper, and cook; limited in spontaneity, not colorful or glamorous; consistently uncritical of others, tried not to blame husband for marital troubles; no hypocrisy; seldom lively or playful but not stiffly prudish or self-righteous; devoted to child, efforts to defend her impressive; passive strength of character but lack of initiative and boldness to form strategy of attack.

This role in one so meek and fragile embodies an unspoken pathos. One feels she is doomed to be overcome.

Eve Black

Party girl, shrewd, childishly vain, and egocentric

Face: pixie-like, mischievous eyes, ephemeral expressions

Posture and gait: suggest light-heartedness and play

Voice: a little coarse, "discultured," mirthful and teasing

Dress: becoming and a little provocative

Skin often reacts to nylon by breaking out

Immediately likable and attractive; touch of sexiness in every word and gesture; never contemplative; to be serious is to be tedious or absurd; devotee of pranks; heedless and unthinking rather than malicious; irresponsibility has cruel results on others; enjoys taunting Eve White; richly vernacular speech, rowdy wit; attitudes and passions whimsical and momentary, quick and vivid flare of many light feelings; ready for any little adventure; meets little details of experience with relish.

Seems strangely "secure from the contagion of the world's slow strain" and from inner aspect of grief and tragedy.

Black was called, she burst into tears and said she was sorry for having been so wicked but that she didn't want to die. The therapist then called Jane. She also began to cry and suddenly screamed, "I won't do it! I won't!" When the therapist asked what she did not wish to do, she cried, "I won't kiss my grandmother! She's cold and dead—and I won't kiss her good-by!"

Jane then began to act like her normal self. She told the therapist that she had felt lost and alone, as Eve White and Eve Black had made what proved to be their last appearance. Then she saw herself, in a kind of waking dream, as a child of six, being led by her mother to her grandmother's coffin and being forced to place a good-by kiss on the dead face. (The grandmother had died only four months after the birth of the resented twin sisters.) Thus the shocking event which had precipitated the dissociation of personality was revealed. Jane knew that neither of the two Eves would appear again and said she felt as if two dear sisters had died. Jane married the man she loved, who had been very understanding throughout her difficulties, and at present they and Jane's little girl are leading a normal life.

ALCOHOLISM AND DRUG ADDICTION

Although somewhat different in their physiological and psychological effects upon the individual, the use of either alcohol or drugs is often based upon a desire to escape from the frustrations of life. Estimates vary widely but there are about fifty thousand people in this country who are addicted to narcotics and nearly a million who are severe chronic

alcoholics (National Association for Mental Health, 1952). Modern clinicians agree that chronic and excessive use of alcohol or drugs is not so much a moral problem as a symptom of a severe emotional disorder.

Alcoholism. Most people can drink moderately without having their use of alcohol seriously interfere with normal social living. The true alcoholic is one who feels such an uncontrollable need to drink that his economic, social, and family life disintegrates; he depends upon alcohol to get himself through the day and cannot face life without it. The chronic alcoholic's body tissues come to demand alcohol, but his anxieties usually are even more insistent in their demands.

How to overcome the evils of excessive drinking is one of the constant problems facing society. The experience with court punishments such as fines and imprisonment has been most unsatisfactory. Nor was another legal measure—national prohibition—successful in reducing the amount of harmful drinking, as indicated by the fact that statistics on the admission of alcoholic patients to state hospitals in New York from 1889 to 1943 reveal no relationship between legal prohibition of drinking and incidence rate of alcoholism (Landis and Cushman, 1945).

Society's bitter experience with national prohibition has produced an increased public willingness to regard drunkenness as a psychological rather than a legal problem. Modern methods of controlling alcoholism rest on the belief that drinking is primarily a symptom rather than the cause of the individual's difficulties. One method of treatment is based

on the conditioned-response principle. The patient is forced at regular intervals to drink alcohol mixed with emetic drugs so that he becomes severely nauseated. It is assumed that, since each such drink makes him ill, he will become sufficiently conditioned against liquor to prevent his drinking. However, unless the patient gets at the root of his emotional problems, his need for liquor will generally be stronger than his conditioning against it, and he will continue to drink.

A much more effective cure for alcoholism comes through personal and social psychotherapy. The therapist helps the patient work out a solution that will give him the satisfactions he is lacking. Often such therapy must be carried on in an institution where the patient can reorganize his emotional patterns without the continual temptation of alcohol as an escape. During recent years, too, many alcoholics have found new help in facing their problems through the organization known as *Alcoholics Anonymous*. By bringing alcoholics together in social activities, Alcoholics Anonymous provides its members an atmosphere of mutual understanding, acceptance, and sympathetic fellowship in which they can work out their problems. Among patients who really want to be cured, this approach to alcoholism has met with considerable success.

Experience shows that therapy works best with individuals who not only desire to be cured but who have only recently begun to drink excessively. The alcoholic of long standing is rehabilitated with great difficulty if at all, because his body has become accustomed to the effects of alcohol and—far more important—because he has come to depend on the extreme escape of alcohol.

Another approach that has given promising results thus far is based on the belief that alcoholism is caused chiefly by a nutritional deficiency (Williams, 1951). Because of their heredity, some individuals have unusually high requirements for certain food elements. If these are not supplied, such persons may turn to alcohol in an attempt to satisfy their cravings. This explanation of alcoholism is based on animal experiments.

In one experiment, for example, rats that had free access to a dish of water and a dish of 10 per cent alcohol showed wide variation in their tendency to drink the alcohol. After being placed on a diet that was deficient in the B complex vita-

mins, all the rats began consuming a great deal of alcohol. When they were returned to an abundant diet, their alcohol consumption dropped overnight. However, different rats responded to different combinations of vitamins.

On the basis of many experiments this investigator developed a potent vitamin capsule designed to meet the needs of most alcoholics and administered it to a number of them. Although some neglected to take the capsules, those who were faithful in continuing the treatment were wholly or partially cured without exception. An aspect of this treatment that would make it more acceptable to many alcoholics is that, once cured, the individual can indulge in moderate drinking without experiencing the compulsion to go on.

Although this method needs further study, it may prove very valuable, especially in conjunction with psychotherapy. Once the alcoholic can be brought to the point where he sincerely wants to free himself of dependence on alcohol, nutritional therapy may enable him to go through with a prolonged course of psychotherapy.

Drug addiction. Widespread publicity has drawn sharp attention recently to the "dope" problem, particularly as it exists among adolescents and young adults. In terms of its prevalence, the menace of drug addiction is considerably less than that of alcoholism—for every narcotic addict in the United States there are about twenty severe alcoholics, plus many others who could be described as "problem drinkers." Except for their abnormal craving for drugs, narcotic addicts seldom display any outward sign of mental disturbance, nor is their general efficiency impaired as much as the chronic alcoholic's (Pescor, 1944).

In certain other respects, however, the problem of the drug addict is much more serious than that of the alcoholic. If he uses either morphine or heroin (both opium derivatives), he soon develops a *physiological* as well as a psychological dependence upon the drug, so that if he does not take it regularly—usually two or more times a day—he becomes physically ill. Furthermore, the user of opiates builds up a gradual tolerance to the drug and must regularly increase his dosage in order to satisfy his need. In some cases dosage becomes so great that it leads to death.

Since the unlicensed sale and possession of narcotics is a legal offense, the addict faces

PSYCHOTIC REACTIONS

another problem which the alcoholic today does not. Not only are drugs very expensive, but addicts must usually rely upon criminals for their supply. They are often driven to peddling narcotics themselves, or to thievery or prostitution, in order to pay for their drugs. It is for this reason that drug addiction is often cited as a major source of crime. Contrary to popular belief, there is little evidence that the influence of drugs themselves leads an addict to violence or the commission of major crimes. When well supplied, narcotic addicts usually feel too buoyant and good-natured to harm anyone.

Psychologically the addict finds a blissful retreat from frustrating reality in his use of drugs. The common narcotics—morphine, heroin, cocaine, and marijuana—usually produce a state of euphoria. The individual feels peaceful and relaxed, often with a peculiar floating or drifting sensation. Narcotics also tend to lower the individual's inhibitions and increase his feelings of self-confidence, sometimes resulting in eloquent, boastful behavior. The person under the influence of cocaine or marijuana may engage in promiscuous or deviant sexual behavior, due both to sexual stimulation by the drug and to a general lowering of inhibitions and impairment of moral judgement. Morphine and heroin, on the other hand, reduce sexual desire and potency.

As with alcoholics, successful treatment of drug addicts requires psychotherapy to help the patient gain emotional insight into his problems and face them realistically. In addition, morphine and heroin addicts require hospitalization for medical "withdrawal" therapy. During withdrawal the patient suffers violently for several days with agonizing physical symptoms such as vomiting, diarrhea, tremors, and cramps.

The outlook for permanent cure in cases of drug addiction has been rather dim. Experience has shown that unless the patient is able to solve his underlying emotional problems, he will not permanently free himself from reliance upon narcotics. In 1943 it was estimated that 75 per cent of addicts treated at federal hospitals sooner or later returned to the use of drugs (Pescor, 1943). The increased use of psychotherapy as part of the treatment has considerably improved the outlook, however, and the number of permanently successful cures may now range as high as 50 per cent (Coleman, 1956).

When frustration and stress become so overwhelming that the individual loses contact with reality, his condition is described as *psychotic*. So disabling is the disturbed mental functioning and distorted behavior of psychotic patients that they nearly always must be placed under institutional care.

In layman's terms, psychotics are usually considered "insane." Strictly speaking, *insanity* is not a psychiatric or psychological term but is a legal concept applied to any mental condition which renders the individual incapable of intent and legally irresponsible for his actions. Thus insanity would include not only psychotic disorders but also extreme, severely incapacitating neurotic reactions.

In spite of the fact that neurotic symptoms overlap psychotic symptoms to a considerable degree, individuals suffering from neurotic disorders seldom become psychotic, even in the face of increased frustration. Psychotic behavior usually develops suddenly without the forewarning of severe neurotic symptoms, although the frustrations that cause the person to break contact with reality may have been active for years. Borderline symptoms, difficult to diagnose as either psychotic or neurotic, are frequently called *pre-psychotic*.

In most cases psychotic reactions are clearly recognizable by their bizarre and sometimes violent symptoms. Psychotic patients generally do not display the anxiety characteristic of neurotics—in denying reality, they no longer recognize the existence of their conflicts and fears. Whereas neurotics are usually aware of the abnormal nature of their symptoms, psychotics rarely recognize or are willing to admit that any of their actions or experiences are at all incongruous or out of the ordinary. To the psychotic, there is little distinction between fantasy and fact—fantasy *is* fact, and of course his actions will be based on this belief.

ORIGINS

OF PSYCHOTIC BEHAVIOR

Because psychotic symptoms may result from either organic or psychological factors, they have traditionally been divided into two categories—organic and functional psychoses. An *organic* psychosis is a disorder resulting

from an irreversible injury to the nervous system due to disease or bodily injury; or to a reversible condition such as malnutrition, glandular deficiency, certain infections, and some little understood chemical conditions. A *functional* psychosis is one precipitated primarily by psychological stress. Disorders involving neural damage tend to be permanent, but most functional psychoses, if given adequate and early psychiatric treatment, can be cured.

Constitutional factors. By definition the organic psychoses are dependent primarily upon physiological disorder that affect the nervous system. Organic damage in these cases is clearly observable. Whether such changes also occur in functional disorders is an open question, partly because present laboratory techniques are inadequate for determining minute neurological changes. It can only be said that there are no *observable* structural changes underlying functional psychoses.

Although functional psychoses are precipitated primarily by psychological factors, there is evidence that heredity may play a role in their development. Numerous studies have indicated that psychotic disorders tend to run in families.

In one long-range study, an analysis of the family histories of over one thousand patients diagnosed as schizophrenic revealed that the statistical probability of a person's developing schizophrenia is directly related to his degree of blood relationship with a schizophrenic patient, as shown in the table below.

Degree of Relationship to Schizophrenic Patient	Probability of Developing Schizophrenia
unrelated	0.85%
step-sibling	1.8
half-sibling	7.0
full sibling	14.3
fraternal twins	14.7
identical twins	85.8

Note that the full sibling of a person with schizophrenia is eight times as likely to develop the condition as is the step-sibling, even though both usually grow up in the same home environment. It was found that the incidence of schizophrenia among children in families where one parent had schizophrenia was 19 times greater than in the

general population, and where both parents were schizophrenic the incidence rate for their children was 85 times greater than normal expectancy (Kallman, 1938).

Studies of twins have also shown that heredity plays a part in the development of mental disease.

In one study of 297 pairs of twins, 67 of which were identical, it was found that among the identical twins there were 41 pairs in which at least one twin suffered from schizophrenia. In 28 of these pairs the other twin also had schizophrenia, yielding a "concordance rate" of 76 per cent. Among the non-identical twins the concordance rate for schizophrenia was only 14 per cent (Slater, 1953).

In unrelated persons paired by chance it is less than one per cent, as we have seen.

Although genetic factors are undoubtedly involved in the development of functional psychoses, it should not be concluded from these studies that such psychotic disorders are directly inherited. Most psychologists and psychiatrists agree that what can be inherited is a *constitutional predisposition* to the psychosis. Under conditions of severe stress, a predisposed individual is much more likely to develop a psychosis than other individuals, who more probably would develop some less severe disorder such as hysteria.

Body chemistry factors. The study of internal chemistry in relation to psychosis has revealed definite evidence that the blood chemistry of schizophrenic patients differs from that of normal individuals—although it is not yet known whether these differences are a cause or result of the psychosis. One difference is that it contains less than the normal amount of a substance called *glutathione* (Martens *et al.*, 1956). The blood of schizophrenics is also able to oxidize adrenaline more rapidly than normal blood can. This is largely because of increased quantities of a substance containing copper and called *ceruloplasmin* (Leach and Heath, 1956; Leach *et al.*, 1956).

Investigators discovered that at one point in the process of isolating ceruloplasmin from the blood a precipitate was formed that was blue in the case of schizophrenic blood only. They decided to see whether injections of this blue substance—which they named *taraxein*, from a Greek word meaning "disorder of the



Following an injection of a substance isolated from the blood of actual schizophrenic patients, the volunteer subject above showed symptoms of schizophrenia; he felt everyone hated him and in return wanted to hurt everyone he contacted. These symptoms disappeared in less than two hours.

mind"—would cause normal individuals to develop symptoms of schizophrenia.

After careful preliminary tests on monkeys, a series of experiments was conducted on human subjects, chiefly prisoners who volunteered to take part in the study. Those who received injections of taraxein developed schizophrenic symptoms lasting about two hours, whereas control subjects receiving a similar substance extracted from normal blood did not. Although the symptoms varied greatly from subject to subject, all those who received taraxein reported marked disorganization of thought and inability to concentrate (Heath et al., 1956).

In recent years studies have also been made with the drugs *mescaline* and *lysergic acid diethylamide (LSD)*, both of which bring on a mental disease state in healthy individuals. These two drugs are not long lasting in their

effects and are used by psychiatrists in the hope of learning more about real mental disease.

In one recent experiment LSD was given to two healthy male graduate students in psychology. One subject reported his experience as follows:

"The pervading feeling was that there was a gulf between me and the rest of the environment. It seemed that it would be impossible for me to communicate with those across this gulf because I could not establish any common points of reference. Also within this state there were hallucinations and a sense of timelessness, all unusual, none of which had any real emotional tone to them" (Fabing, 1955).

Another investigator, working with groups of nonpsychotics to whom he gave LSD, found that they derived some benefit from the experience and "almost invariably" wished to return and participate in more group experiments.

Under the influence of the drug, the subjects felt that they were undergoing severe stress, but they felt able to deal effectively with the situation. Thus their ego structures seemed to be strengthened by the experience. It was found inadvisable to leave a subject alone, however, for even such a simple activity as going through a cafeteria line alone could cause severe anxiety while the subject was under the influence of LSD (Abramson, 1956).

A great deal of additional research is needed in this area, but it may well be that experiments on drugs, taraxein, and other aspects of body chemistry will lead to better understanding of psychotic disorders and thus to better methods of therapy.

Environmental factors. Although the exact degree to which heredity and environment interact in the development of functional psychoses is unknown, both factors are unquestionably important. Clinical psychologists are convinced that the emotional problems responsible for the development of psychotic behavior in adults can in most cases be traced to early childhood experiences. Faulty parent-child relations, for example, are frequently found to underlie the appearance of psychotic patterns in later life. Just as genetic factors can predispose an individual biologically, so

such psychological factors as parental rejection or overprotection, excessive or inconsistent discipline, extreme childhood hostility and insecurity, or strong feelings of guilt may lead to a psychological predisposition to mental illness in adulthood.

In one recent study one hundred mothers of male schizophrenics and one hundred mothers of normal men were asked to indicate which items they agreed with in a list of statements regarding the proper rearing of children. The mothers of the schizophrenics believed in allowing children much less freedom than did the other mothers. Among the items with which most of the mothers of schizophrenics agreed and most of the other mothers did not agree were: "Children should be taken to and from school until the age of eight just to make sure there are no accidents"; "If children are quiet for a little while a mother should immediately find out what they are thinking about"; "Children should not annoy parents with their unimportant problems"; and "A child should not plan to enter any occupation that his parents don't approve of" (Mark, 1953).

Another study shows significant differences in the home environment of children who later became schizophrenic as compared to that of other disturbed children. (If the preschizophrenics had been compared with normal children, even greater differences would probably have been found.) Records of male schizophrenic patients in a psychopathic hospital were examined, and twenty-three who had formerly attended a children's psychiatric clinic were studied. The control group was obtained by selecting for each case in the study group the next male child of the same age who was studied at the clinic but for whom there was no report of later schizophrenia. The study revealed that about half of the parents of the control group had a reasonably normal marital adjustment, but none of the parents of the preschizophrenics did. In addition, the personalities of the study group parents were more often domineering, irritable, cold, or ineffectual, if not actually neurotic or psychotic, than was the case for the control group. Many more of the mothers of the preschizophrenics were overprotective or inconsistent, and the fathers tended to show more rejection and cruelty than those of the control group. In six cases a child who later became schizophrenic had an overprotective mother combined with a cruel father, making it impossible to obtain normal emotional gratification from either parent (Frazee, 1953).

It is little wonder that children living in such an unhappy home environment often develop unhealthy emotional patterns which they can never overcome without help. Of course, the fact that many children do weather stormy childhoods is additional evidence that environmental influences are not all-important in the development of psychoses.

SYMPTOMS

OF PSYCHOTIC BEHAVIOR

Besides losing contact with reality, the psychotic shows marked disturbances in his behavior and thought processes. The classification of functional psychoses is shown in the chart below. Three frequent types of psychotic symptoms, occurring either singly or in various combinations, are: (1) hallucinations, (2) delusions, and (3) distorted emotional behavior.

Hallucinations. Psychotic patients (especially schizophrenics) frequently experience *hallucinations*—sensory impressions of external objects in the absence of any appropriate stimulus in the environment. Most frequently, hallucinations are auditory—the individual hears strange, confusing noises, or voices which speak to him in command or criticism. Such auditory hallucinations often fit into a delusional system. For example, if the patient thinks that he is a prophet, he may receive hallucinatory messages which he claims come from God. In other cases the patient may

Classification of Functional Psychoses

disorder	symptoms
schizophrenic reaction	retreat from reality, with emotional blunting and disharmony and marked disturbance in thought processes; delusions, hallucinations, and stereotypes common; nine subgroups: simple, hebephrenic, catatonic, paranoid, childhood, acute undifferentiated, chronic undifferentiated, schizoaffective, and residual
paranoid reaction	logical, often highly systematized and intricate delusions with personality otherwise relatively intact; two types: paranoia and paranoid state
affective reaction	extreme fluctuations of mood, with related disturbances in thought and behavior; two major subgroups: manic-depressive and psychotic depressive
involutional psychotic reaction	abnormal anxiety, agitation, delusion, and depression in later years, without previous history of psychotic reaction; two types: those characterized chiefly by depression and those centering around paranoid ideas

have no idea who is "talking" to him, although he may carry on lengthy, bizarre conversations with his hallucinatory intruder.

Psychotic patients may also experience hallucinatory tastes and smells. These frequently accompany delusions of persecution. The "persecuted" person may complain that his enemies have released some poisonous gas into his room or placed some peculiar tasting poison in his food. Visual hallucinations are comparatively rare in functional psychoses, although they are common in some organic psychoses such as *delirium tremens*, resulting from severe alcoholism. When they do occur in functional disorders, they usually take the form of "visions" in which God or a saint makes some revelation to the patient. Such hallucinations are unmistakable evidence of the psychotic patient's loss of contact with reality.

Delusions. A strong belief which is opposed to reality and which the individual steadfastly maintains in spite of logical persuasion and evidence to the contrary is called a *delusion*. Patients who experience persistent systematized delusions are said to be *paranoid*, or to suffer from *paranoia*.

There are three main types of delusions; the most common kind is the *delusion of grandeur*. The patient believes he is some exalted being, such as God, an emperor, a millionaire, or a great inventor. One woman patient in a mental hospital had a pleasing personality and was well enough adjusted in most ways that she was trusted with many duties, including that of helping show visitors through the institution. But nothing could shake her firm conviction that she was really Bing Crosby's wife.

A second type of delusion is the *delusion of reference*. In this case the individual misconstrues chance happenings as being directly aimed at him. If he sees two people in earnest conversation, he immediately concludes that they are talking about him. If his bed is changed to a new position in the ward, it is because the attendants are displeased with him and want to guard him more closely or because he is being rewarded for good conduct. Nothing is too trivial or too accidental to escape notice as having some definite personal significance.

The third type of delusion is the *delusion of persecution*. Here the individual is constantly on guard against his "enemies"—he feels that he is being spied upon, plotted against, and in mortal danger of attack.

Frequently delusions of persecution are accompanied by delusions of grandeur—the patient is a great man, but he is opposed by evil forces. The following illustration presents a typical case involving delusions of persecution:

" . . . a woman of 75 . . . believed that her son-in-law planned to sexually assault and kill her. Her reaction to this idea was expressed in many letters sent to friends and relatives, mailed surreptitiously, and causing the daughter and son-in-law much embarrassment. Aside from this idea, the woman behaved normally and at no time did she show any tendencies to violence. . . . As she became friendly with the examiner she began to verbalize her delusion, explaining that she based her idea on the fact that articles in her room were sometimes disarranged, that the son-in-law walked past her door unnecessarily or looked at her in a strange manner. Becoming enthusiastic about her subject, she suddenly stated that her daughter's husband was really a reincarnation of a lover of the patient in her youth. She brought out an old picture to verify the 'resemblance' and then launched into a story of the man to whom she as a girl had been engaged . . ." (Bosselman, 1950).

If the patient is pressed to account for the discrepancy between his delusion and present reality, he resorts to some substantiating, or secondary, delusion that is just as real to him as the primary delusion. If a patient who believes himself to be St. Peter is asked why he is scrubbing the floor of the hospital ward, he replies that he has been sent to earth in



disguise to find out which persons are obeying the will of God and which ones are not. He will explain that he is keeping a list of the moral transgressions of patients and staff members and that the evildoers will be punished, even as the good will be rewarded. The development of such secondary delusions is evidence of the faith the individual has in his original delusions. To him they are so real that it never occurs to him to question them. If they are discrepant with what other people say, then the other people must be wrong.

Emotional distortion. The emotional behavior of psychotic patients is usually distorted, either by a general blunting of emotional responsiveness or by exaggerated displays of gloom, elation, fear, anger, or sexual behavior.

Catatonia. In one schizophrenic reaction, known as catatonia, the patient may be violently and inappropriately disturbed in his emotional reactions or at another time may remain completely motionless and unresponsive to any type of stimuli, maintaining a single posture for hours. Catatonic stupor represents extreme apathy and withdrawal from reality. Nevertheless, patients frequently recover from it, as in the case of Clarence R.

A brilliant student, Clarence suffered a severe breakdown during his third year of college and was admitted to a mental hospital. The causes of his illness were deep-seated and complex and need not concern us here.

While he was in the hospital, Clarence heard voices and often talked of a machine to control human thoughts. Once the therapist approached him on the hospital grounds and called his name but was unable to get his attention. Clarence was staring into space, the tip of his index finger pressed against his lips. The therapist found it difficult to move the finger but finally succeeded in raising Clarence's arm above his head. There it remained, in the awkward position in which the therapist had placed it. The therapist pinched Clarence and even stuck him with a pin, but Clarence did not move an eyelid. He was in a catatonic stupor. For ten days he remained silent and motionless and had to be forcefully fed. Then suddenly he emerged from the stupor, exclaiming, "I have been born again." After this he improved rapidly and was able to respond to psychotherapy. At the time his case was written up, he had been well for two years. He was working in a plant nursery, where he carried out some inter-

esting experiments in crossbreeding, and was planning to return to college the next year (Strecker, 1952).

Depressive and manic reactions. In some psychotic disorders the patient's predominant symptom is a generalized slowing down of mental and physical activity, accompanied by gloom, morbid thoughts of disease and death, and feelings of worthlessness. During such *depressive* episodes, patients frequently attempt to commit suicide and must be carefully watched. The speech of psychotically depressed patients is slow and laconic; when they do speak, it is generally to express their suffering and suicidal desires.

In sharp contrast to psychotic depression is the *manic* reaction, which is characterized by high excitement, elation, and restless activity. The manic patient indulges in frequent boisterous laughter and eloquent, loud speeches. He walks about wildly and gestures dramatically, banging upon the walls and furniture.

Elizabeth was a typical example of severe manic-depressive psychosis. From the age of eighteen until her death at fifty-four she alternated regularly between depression and mania, each state lasting exactly 28 days. During her depressions she sat slumped in a chair, scarcely moving, feeling miserably unhappy. During the manic period she was a whirlwind of misdirected energy. She would often smear her face and body with lipstick, put on a headdress made of grapefruit rinds and bits of cloth, tie red rags around her legs and arms, and sing at the top of her voice, "I'm a copper-colored maiden." For hours at a time she would talk so rapidly that she could scarcely be understood. One fragment of her cascade of speech was the following: "Will you come to a Hallowe'en dinner and dance . . . at least 100 crazy loons and 100 nurses, also your friends from the east, also your former enemies . . . Louis will bring a zither player, a glass of wine, some angel cake, and you—music that I heard from you was more than music, bread that I broke with you was more than bread" (Strecker, 1952).

Such severe manic and depressive episodes represent emotional distortion in its extreme form. More often the emotional behavior of psychotics is merely inappropriate to the situation; they may giggle frequently for no apparent reason, suddenly break into tears, or alternate rapidly from one mood to another.

But whatever specific symptoms a psychotic patient may display—whatever combination of delusions, hallucinations, and emotional distortion—the essential fact remains that he is to some extent out of tune with reality.

S U M M A R Y

Human adjustment is a never-ending process of dealing with frustration. In seeking various goals we may be frustrated by *environmental* obstacles, by real or imagined *personal* limitations, or by a *conflict* of one motive with another. Conflict frustration may be of three kinds: conflicting attraction, attraction-repulsion, and conflicting avoidance. Because frustration of any sort produces unpleasant emotional upheaval, it strengthens our motivation to satisfy a need that has been thwarted.

Our most painful frustrations are generally those that are *ego-involving*. To protect our self-concepts against frustrations that threaten them, we use a number of behavioral devices known as *defense mechanisms*. These may be classified tentatively as withdrawal reactions, aggressive reactions, and compromise reactions.

Withdrawal reactions include flight into *fantasy*, as through daydreaming; *nomadism*, or aimless wandering to escape frustration; *regression* to childish modes of adjustment; and *repression* of unpleasant thoughts and impulses. Repressed feelings remain active at an unconscious level and usually find expression in disguised forms of behavior. Sometimes repression is accompanied by *reaction formation*, a mechanism by which the individual develops conscious attitudes that directly oppose his repressed feelings. Repression can be severely handicapping when it prevents an individual from recognizing the underlying source of his problems.

Aggressive reactions to frustration seldom take the form of direct attack. Instead, hostility is usually *displaced* onto some person or object less threatening (or more accessible) than the one actually responsible for the frustration. The most common forms of displaced aggression are *scapegoating*, “*free-floating*” anger, and threatened or attempted

suicide (self-directed displacement). Aggressive feelings are sometimes expressed even less directly through the mechanisms of *identification* and *projection*. Society can best control the aggressive tendencies of its members *not* by punishment (which tends to increase frustration) but by allowing people to work off their hostile feelings in harmless ways—either verbally or in some vigorous activity. This is known as the method of *controlled expression*.

Compromise reactions to frustration include *sublimation* and *substitution*, both involving the pursuit of alternate goals; *compensation* and *overcompensation*, designed to overcome feelings of inferiority; and *intellectualization*. The three basic mechanisms of intellectualization are *rationalization* (excuse-making), *isolation* (separation of conflicting attitudes into “logic-tight” compartments); and *undoing* (ritualistic cleansing behavior).

These mechanisms of withdrawal, aggression, and compromise are typical defensive reactions to frustration. Unless they are relied upon so much that they interfere seriously with adjustment, they may be considered essentially normal reactions.

Occasionally an individual's usual adjustive responses are inadequate for dealing with very severe frustration. In such case his reactions may become exaggerated and disorganized. Abnormal reaction patterns are classified either as *neuroses*, disturbances that may be either mildly or seriously incapacitating but seldom require hospitalization; or as *psychoses*, very severe disturbances that are characterized by partial or complete loss of contact with reality.

Although neuroses take many forms, the chief symptom of most neurotic disorders is *anxiety*—a generalized feeling of worry or fear that typically is accompanied by guilt feelings. Another predominant element in most neuroses is a *conflict* between the neurotic's feelings of personal inadequacy and his desire for self-fulfillment. Most neurotic disorders share these general characteristics, but specific symptoms vary a great deal both in kind and severity. Typical neurotic reactions include: *phobias* (irrational fears), *obsessions* and *compulsions*, *hysteria* (the appearance of physical symptoms with no organic basis), *neurasthenia* (characterized by chronic fatigue and vague symptoms), and such dis-

sociative reactions as *amnesia*, *fugue*, and *multiple personality*. Chronic *alcoholism* and *drug addiction* are other symptoms of neurotic disorder.

Although neurotic and psychotic symptoms overlap, psychoses usually develop suddenly without the forewarning of a severe neurosis. *Organic psychoses* are related to neural damage caused by injury or illness. *Functional psychoses*, on the other hand, are precipitated primarily by psychological stress—although certain individuals seem to inherit a *constitutional predisposition* to such disorders. Recent experiments have indicated that differences in *body chemistry* also play a part, but the relationship between cause and effect has not yet been established. *Environmental factors*—particularly childhood experiences—also seem

to predispose certain individuals to serious mental illness.

All psychoses are characterized by partial or complete loss of contact with reality. The most frequent symptoms of psychotic behavior, occurring either singly or in combination, are *hallucinations* (sensory impressions of external objects in the absence of an appropriate stimulus), *delusions* (strong beliefs opposed to reality—such as delusions of grandeur, of reference, or of persecution), and *emotional distortion*. The latter may be characterized by alternate exaggerations and blunting of emotional responsiveness (catatonia) or by extreme displays of elation and gloom (manic and depressive reactions). Most functional psychoses, if given adequate and early treatment, can be cured.

CHAPTER EIGHT

MENTAL HEALTH AND THERAPY

THE MENTAL HEALTH MOVEMENT

TECHNIQUES OF PSYCHOTHERAPY

PHYSICAL METHODS OF THERAPY

SPECIAL TECHNIQUES OF THERAPY

INTEGRATED THERAPY

Throughout most of history, people have believed that mental illness was caused by supernatural powers and witchcraft. Because of this, they have regarded it with fear and aversion. Until recent times the mentally ill were often placed in jails or workhouses; and in asylums such as England's infamous "Bedlam," established around 1400, patients were cruelly confined and beaten. Because of the mystery that surrounded unusual behavior, a great deal of social stigma was attached to the mentally ill. As men have learned more about the causes of mental illness, this prejudice has gradually lessened, although a certain amount remains even today.

In recent years psychiatry and clinical psychology have made many advances in the prevention and treatment of mental illness, but many problems still remain unsolved. In this chapter we will review some of the practices which currently are giving good results.

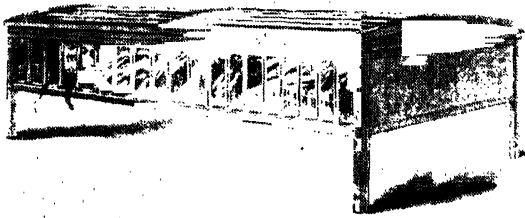
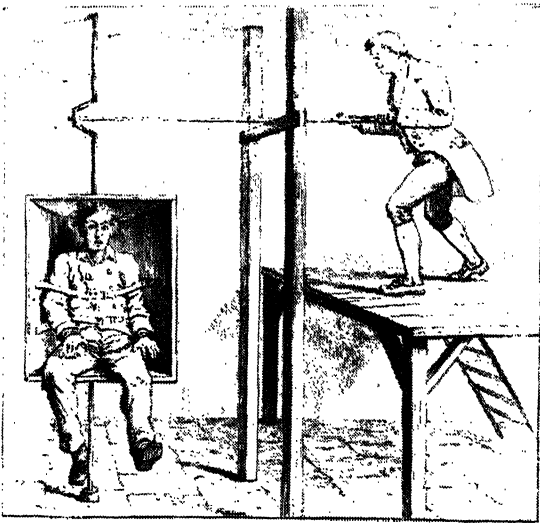
THE MENTAL HEALTH MOVEMENT

Present-day knowledge that mental patients suffer from illnesses which usually can be prevented or cured has given great impetus to the *mental health movement* started in the United States by a medical doctor, Clifford W. Beers, during the early years of this century (Beers, 1908). Dr. Beers' crusade was motivated by his years as a patient in several different mental hospitals, where he had experienced the brutal treatment and cruel confinement existing in such institutions at that time. The mental hygiene movement that he initiated after his recovery was an active protest against these inhuman conditions. His plea was for more humane and, at the same time, more effective treatment procedures.

The crusading activities of Beers resulted in 1909 in the establishment of the National Committee for Mental Hygiene. Today there are numerous voluntary mental health associations which operate on local, state, and national levels. Voluntary mental health associations differ from government agencies, such

as the National Institute of Mental Health, and from professional agencies, such as the American Psychiatric Association (Stevenson, 1953). The voluntary associations do not undertake to provide or operate facilities for the mentally ill, except for experimental or demonstration purposes, but rather work for the assumption of these responsibilities by public, private, and professional organizations which are concerned with mental health. Voluntary mental health associations can act as "eyes and ears" for the general public and often initiate services in areas which have been neglected by governmental agencies and by professional groups.

The mental health movement was slow in gaining impetus until World War II brought the problem to the public's attention in dramatic fashion. Since then, increased concern with the tasks of preventing and treating mental illness has been apparent. An important step forward was the passage in 1946 of a National Mental Health Act, under which the National Institute of Mental Health was even-



Treatment of the mentally ill has not always been humane. In 1818 the circulating swing, "which no well regulated institution should be without," was supposed to cure depression. Confinement in a "crib" was used in a New York institution as late as 1882.

tually established. This organization is concerned primarily with research and training, but it also gives financial support to mental health services in states and communities that will match dollars with it. Although this program does not give complete coverage of mental health needs, it has been tremendously helpful.

In 1953 the Veteran's Administration adopted a new policy designed to encourage cooperation between the VA psychiatric hospitals and the state programs (Stevenson, 1954). The American Psychiatric Association has established a Central Inspection Board, which assumes professional responsibility for overseeing the quality of service given to mental patients in hospitals. The American Medical Association has also made its inspection of mental hospitals more stringent.

Thus, in addition to educating the public to accept a humane and scientific attitude toward mental illness, mental health workers during the past fifty years have brought about marked progress in the actual control of mental illness. Their contributions have fallen into two main categories. First, they have created public awareness of the importance of psychological *prophylaxis* in preventing mental disorder; and second, they have emphasized the use of *psychotherapy* for the treatment and cure of the mentally ill.

PROPHYLAXIS

In mental health, as in physical health, *prophylaxis* refers to the use of precautionary methods to prevent disease. Such prophylactic measures as pure food and drug laws, the establishment of sanitary living conditions, and the use of antidisease serums have made the standard of physical health in the United States far superior to that of most other countries. Yet most Americans are still comparatively unaware of existing facilities for safeguarding their mental health. Good physical health, of course, is one requisite of good mental health, which therefore involves biological as well as psychological prophylaxis. In the present discussion, however, we shall be concerned primarily with the psychological aspects of prevention.

Parent-child relationships. As previous chapters have pointed out, a healthy emotional life during infancy and childhood is extremely important in the development of satisfactory adjustment patterns in later life—the child whose emotional needs remain frustrated becomes a potential neurotic or psychotic. It is now generally recognized that the most important of all factors in preventing mental illness is emotional security, which has its roots in healthy parent-child relations. Accordingly, great emphasis is being placed on techniques of child-rearing. Although it is difficult to lay down specific rules for rearing children, psychologists are generally agreed on the value of the following principles (Coleman, 1956):

1. Adequate psychological mothering during infancy; prevention of anxiety due to unnecessary frustration of the infant's biological and psychological needs.

2. Self-demand feeding schedules—allowing the infant to set his own rhythm of life activity.
3. Freedom for the child to follow his own pattern of development. Training in social skills, such as manners and toilet habits, given casually only when the child has reached the necessary maturational level.
4. Consistency in parental discipline and in parental values, providing the child with adequate ethical models but not unnecessarily restricting his natural exploratory behavior aimed at learning about his physical and social environment.
5. Most important, provision of a loving and permissive atmosphere in which the child is respected and made to feel that he "belongs" and is loved unconditionally—that parental love is not contingent on good behavior.

Healthy parent-child relationships will go far toward producing a well-adjusted child who will, in turn, develop into a well-adjusted adult.

Adjustive behavior in everyday life. Not all prophylaxis takes place during childhood. There are principles of good adjustment which may be deliberately cultivated by college students and older adults. Several will be briefly mentioned. An individual's success in using them will depend, of course, on the extent to which he is free from dependence on the self-deceiving defense mechanisms discussed in the previous chapter:

1. Knowing which elements in the external situation can be changed to fit your needs better and accepting without resentment the ones which cannot be changed.
2. Improving your competence to handle situations: learning to dance well and converse easily if you feel awkward in social situations, or developing vocational competence if you fear that you may lose your job or that you may not be promoted.
3. Acknowledging and accepting your emotions. Wartime studies showed that admitting fear when in serious danger helps keep that fear from becoming intolerable. Much mental illness seems to grow out of the patient's inability to accept as part of himself the sexual desires or hostilities or other motives that he has learned to feel are degrading or morally wrong.
4. Keeping busy in constructive work which you feel is valuable. This is one of the best routes to a feeling of achievement, adequacy,

and self-esteem. When this source of satisfaction is removed, as in old age, the individual is apt to develop feelings of discouragement, depression, and worthlessness. Even in a real emergency situation, keeping busy can help to combat depression or allay fear.

5. Cultivating a sense of humor, especially about yourself. The ability to see the humor in a situation has saved many an awkward moment in the classroom, on the job, and in social life. Laughter can go far to sweep away annoyance, worry, jealousy, and even timidity and fear.

6. Sharing in social activities and responsibilities. We all need companionship, and we all thrive on the satisfaction of being a valued, contributing member of a group.

7. Reinterpreting situations. Often our frustrations are the product not of anything in the external situation but of faulty evaluations on our part. Maybe the professor brushed aside your question not because he thought it was stupid, as you assumed, but because he is an insecure person who feels threatened by interruptions. Our self-pictures, too, are often distorted, as we have seen. Re-evaluation in the light of reality may be very difficult and may even require the help of a friendly outsider, such as a minister or teacher trained in counseling techniques, or a clinical psychologist or psychiatrist.

Growth of guidance facilities. Perhaps the most effective achievement of the mental health movement is the phenomenal rise of psychological clinics and guidance centers during the past few decades. Assisted by federal aid granted under the National Mental Health Act of 1946, state and community mental health agencies are now widespread throughout the country. Using teams made up of psychiatrists, psychologists, and social workers, such agencies offer services and aid to people with problems in child guidance, marital adjustment, vocational adjustment, and other personal matters. In some cities special recreational facilities and guidance centers are now being provided especially for handling the unique adjustment problems of older people.

Still in its infancy, the mental health movement is gaining a foothold and increasing its sphere of influence. Youth clubs, designed to curb juvenile delinquency at its source, have received widespread public support.



In the Community Child Guidance Centers of Chicago, several mothers watch a counselor interview a troubled mother and then, in her absence, her children (above). Next the children return to the playroom, where their behavior is observed and later reported to the group, while the mother comes back to discuss the situation with the other mothers. This may be repeated weekly until the problems are under control.

Employers (as we shall see in Chapter 17) are showing an increasing tendency to consider the emotional needs as well as the economic needs of their employees. Many school systems employ school psychologists and guidance services, and many teachers are now encouraged or required to take courses in mental hygiene counseling. The popularity of all these efforts indicates growing public concern over the mental health problem.

Although guidance facilities have been growing rapidly, the supply still falls far short of the demand. One outstanding expert provides the following realistic analysis and estimate:

"It is generally believed that every 50,000 of the population need an all-purpose mental hygiene or psychiatric clinic. This suggests something like 3,200 out-patient clinics of one team each, or 3,200 full teams for out-patient services. Since children correspond to approximately 25 per cent of the population, one might say that special child guidance clinics might quite logically be estimated at one fourth of the total number of clinics, which will

give you a figure of around 800. Then if one were to weight this figure by assuming that child guidance clinics are in general about twice as necessary as adult clinics, because of the parents and children both being involved and because of the extremely vulnerable and susceptible period involved in childhood, it seems to me fair to say that there should be approximately twice as many as the population would call for, in other words, around 1600. I offer this as a suggestion to be attacked, elaborated, defended, but above all, carefully studied to see whether or not there is any approach such as this that one can logically use in such an estimate.

"I think that it should be made very clear that this is sort of a rule of thumb approach; nevertheless, to me it suggests that we would like to have around 1600 child psychiatrists, about 1600 clinical psychologists, and about 3200 psychiatric social workers in the teams for the care of children throughout the country" (Blain, 1956)

We are a long way from reaching this goal, for at the time of writing there are only about twelve hundred mental health clinics in the United States—nearly half of them part-time clinics (National Association for Mental Health, 1956). The number of clinical facilities must *at least be tripled* before it will be adequate to meet present needs.

RECOGNITION OF PSYCHOTHERAPY

Psychotherapy, which literally means "mental healing," is a term applied to the treatment of personality and behavior disorders by psychological methods of therapy—in contrast to physical methods such as drugs and surgery. Psychotherapy is as old as recorded history. It is referred to in the Old Testament and in the writings of the ancient Greek philosophers. Among the ancients, psychotherapy was relegated to the priests, who employed magic, incantations, music, and similar techniques designed to drive out the evil spirits which they believed to be the cause of mental illness. Mental healing is certainly not a twentieth-century innovation, but the development of modern psychological techniques has established psychotherapy firmly among the healing arts.

Goals of psychotherapy. The fundamental objective of all psychotherapy, regardless of

the specific techniques employed, is to help the individual improve his *modes of response* to real-life situations. To accomplish this end, psychotherapy does not limit itself to giving the client intellectual insight into his personality problems. It tries to help him improve his emotional responses, his ways of handling difficulties, and his ability to meet his fundamental needs.

Practitioners of psychotherapy. Psychotherapy is a broad field that calls upon a variety of professional services. Among the general public some confusion still exists as to the functions and legal status of the various kinds of practitioners who treat mental disorders. Here we shall consider the psychiatrist, the neurologist, the psychologist, the psychoanalyst, and the psychiatric social worker.

The *psychiatrist* is an M.D. who practices that branch of medicine which treats mental illnesses, whether of psychological or organic origin. The law provides penalties for the nonmedical man who calls himself a psychiatrist. The psychiatrist may legally give medicines, prescribe diets, use surgery, and administer electro-shock therapy. He may also practice psychoanalysis or any other method of psychotherapy. In England he often calls himself a psychologist.

The *neurologist* also is an M.D. He specializes in the treatment of mental abnormalities which have their basic origin in unhealthy body tissue, usually in the brain and nervous system. He uses surgery, diet, drugs, exercises, electro-shock, and other physical treatments. Frequently a physician practices both neurology and psychiatry; he is then called a neuropsychiatrist.

The *psychologist*, in most states, does not have legal status or protection by law. However, ethics demand that the nonmedical psychologist who practices psychotherapy, whether or not for a fee, must have training and supervised experience comparable to that required of the medical practitioner. This usually means having a Ph.D. degree from an accredited university.

The *psychoanalyst*, as we shall see, has a special system of theory and practice which distinguishes him from other clinical psychologists and psychiatrists. Theoretically, any person who chooses to call himself a psychoanalyst may do so, because the law does not define his status and training. The organized

psychoanalysts in this country, however, now require the practitioner to possess an M.D. degree—even though Sigmund Freud, the originator and acknowledged leader of the psychoanalytic movement, argued that some of the most valuable contributions to the development of psychoanalysis had come from men without medical training. Today many non-medical workers are making quite extensive use of the concepts and techniques of psychoanalysis, even though they are not thoroughgoing psychoanalysts in either theory or practice.

The *psychiatric social worker* is a specialist in one particular area of social work. His special training consists of two years of post-graduate study, leading to the degree Master of Social Work. Often the psychiatric social worker has a direct working relationship with a psychiatrist in charge of a case. He studies the social realities of the patient's situation: his interpersonal relationships, especially with family members, and the socioeconomic and cultural factors that affect the family as a unit. This information about the patient helps the psychiatrist or clinical psychologist make a dynamic diagnosis. In addition to supplying this data, the psychiatric social worker contributes to treatment by helping the patient and his family with problems related to the mental problem itself; with obstacles to the acceptance of psychiatric care; and with problems of social relationships. Trends toward preventive work, a positive program for mental health, and the growing number of people seeking mental health services are causing some psychiatric social workers to move into nonmedical settings such as mental health education and counseling services.

The problem of privileged communication. The practice of psychotherapy is complicated by the fact that the patient may reveal legal guilt in connection with some punishable crime. Everyone who learns such information is responsible for reporting it to the authorities unless he enjoys "privileged communication." This privilege is at present granted to all lawyers and clergymen who are duly registered and licensed to practice. Not all states grant privileged communication to physicians, nor is it enjoyed by medical officers in the armed services. Clinical psychologists are working toward the legal right of

privileged communication and as of 1957 had achieved it in Arkansas, Georgia, Kentucky, Tennessee, Washington, New York, New Hampshire, and California.

TECHNIQUES OF PSYCHOTHERAPY

The types of psychotherapy being practiced today are many. Therapy varies with the nature of the individual case being treated and with the personality, educational background, and convictions of the therapist. In some cases the differences are of method only; in others they represent basic differences in the theory of personality and correspondingly different beliefs about the proper function of therapy. For example, some therapists believe that they should give complete direction to the patient; others center responsibility entirely in the patient. Such variations clearly reflect basic differences in the theory of human personality and how it changes.

It should be remembered, however, that all techniques of therapy are directed toward the same ultimate goal—helping the individual make a more satisfactory adjustment to his problems—and that each method has much in common with one or more of the others.

To varying extents, all types of psychotherapy employ the principle of *catharsis*, or the discharging of emotional tension by “talking out” or otherwise expressing one’s troubled emotions. Because most of the problems that worry people involve ideas and experiences which are psychologically painful, catharsis is usually a slow process. Early sessions with the therapist are likely to seem unproductive. When the patient is instructed to talk about what worries him or about anything that comes into his mind, he will usually stick to the superficial aspects of his problem at first. In succeeding sessions, however, he will become more and more frank, search more and more deeply into his own problem, and eventually tell of experiences and emotions which have long been concealed from himself as well as from others.

DIRECTIVE COUNSELING

In the simplest and most limited type of psychotherapy or counseling, the therapist supplies direct answers to problems which are consciously worrying the client. Directive counseling is practiced by teachers, ministers, physicians, social workers, lawyers, employment interviewers, and parents and friends, as well as by counselors connected with guidance clinics. The techniques of reassurance, suggestion, interpretation, and questioning, as well as information-giving may be employed.

Counseling of this kind has many values, especially in offering quick solutions to many types of relatively minor problems. In cases which call for more than information and encouragement, however, it has limitations. It may even be harmful if it encourages the individual to rely on others for the solution to his problems or if it prevents or delays treatment of serious emotional disturbances.

CLIENT-CENTERED THERAPY

A completely *nondirective* technique is that of client-centered therapy, developed largely by Carl Rogers. Nondirective therapy is based on the premise that an individual can work through his own problem if he becomes free enough from self-deception and fear to recognize the problem for what it is. Accordingly, the patient is encouraged in an interview situation to talk freely about anything that troubles him and to approach it in any way he likes. The therapist neither praises nor blames but accepts whatever is said, perhaps rephrasing it or helping the individual to clarify his own reactions.

The theory of nondirective therapy is that by “talking out” in a permissive atmosphere, the client will himself come to understand certain relationships between his feelings and his behavior. Emphasis is laid on the concept of therapy as a “growth process” in which the patient utilizes his own potentialities to achieve a more mature level of emotional adjustment. From the beginning, the client is responsible for his own behavior and his own decisions, as well as for the course of therapy. There is a strong *disbelief* by advocates of this technique that “the doctor knows best.” Superficially the role of the therapist is that

of "reflecting" back to the client the feelings he has expressed. Actually, however, the therapist's attitude of acceptance and concern is probably of greatest significance, for it helps the client develop the strength to handle his difficult problems of adjustment.

The following case illustrates the nature of nondirective therapy and also the gradual change from negative feelings to positive ones which is characteristic (Rogers, 1947).

Mary Jane Tilden, age twenty, was brought to the counselor by her mother. She seemed to be retreating from life, spending the major portion of her days sleeping, listening to the radio, or brooding. She had given up her job and all social contacts; she rarely bothered even to dress. Her first interview was completely negative except that she did decide to return for further treatment:

Miss T.: "It's just when I compare myself to the other girls it seems—I don't feel at all up to it . . . they seem to be so normal in everything they did and they were unfolding the way everybody should unfold in this world. And when I thought about myself, I thought, 'Well, my gosh! I'm not even coming near it.' And it was just such a blow that—I just started to realize that I wasn't coming along the way I should—I mean I just wasn't progressing."

Counselor: "It wasn't that you were jealous, but that you gradually realized that here they were ready for a new part of their life and you just weren't ready for it. . . ."

T.: "Yes—I seem to be going backward all the time. In fact, I don't see any reason why I should be living. . . . It's very funny, I can see it for everybody else but I can't—I have enough confidence in other people's ability but I can't see it for myself."

C.: "You can understand why other people would want to live but for yourself you can see very little reason. . . ."

T.: "There's one thing I can't quite make up my mind—I've tried to figure it out—well, what is it, when I get into a rut like this, what is it that I really want? And when I examine myself I can't figure out what I really want. It's only by looking at what other people want that I think, well, maybe that's what I want. It's a very odd thing, and I don't like it. That's what makes me feel—that it's—a—that I can't do what I want to do because I don't really know what I want."

C.: "You feel that, so far, the best you have been able to achieve along that line is just to take a goal that seems to be good for somebody else. But that

you don't feel that there's any real gain that you are sure you want. . . ."

T.: ". . . I—I—can do something, or I can go through an experience, and I feel, well, I haven't done so badly and then the next minute, 'Oh, no.' Immediately something inside attacks me and tears me down. And it discourages me, discourages me to the point where I don't want to repeat it."

C.: "In other words, your own evaluation of yourself fluctuates so that it's very discouraging."

During the fifth interview Miss Tilden discussed her first tentative steps toward improving her situation, but with many reservations:

T.: "Well, I've gone out a little bit more than I had been . . . that is—visiting more—and I've been with people more, but I still basically feel the same."

C.: "As I get that, you've done some things about it, I mean like trying to mingle a little bit more with people, but it still leaves something to be desired."

During Miss Tilden's eighth interview, she reported that she was working; however, her sense of dependency had not abated:

T.: "Well, perhaps being at home has something to do with it—I mean my mother has always been very good to me. She had a very miserable childhood, her parents never paid any attention to her, then she tried to make up for it, and that way it didn't affect the others [siblings] because they didn't accept it, but I accepted what she did for me and I just took it for granted, and it made me more reliant on her, really."



Dr. Carl Rogers, chief developer of nondirective therapy, has found that if the therapist provides a permissive, accepting attitude and does not evaluate or advise, his client gradually is able to analyze his own reactions and feelings and achieve a more realistic and constructive outlook.

C.: "You feel that because of some of her very real needs that—she did a great deal for you and you accepted it and depended on her. . . ."

T.: "It seems to me I just repeat the same old story over and over again. I, well, I guess I have made some progress. I'm considering taking up millinery designing. I've always sort of wanted to do it, so I've decided I would, and I'm going to register this week. I don't expect what I used to expect from things, I mean I don't expect it to give me a lot of happiness or anything, I'm just going to take it because I want to. That's all."

C.: "You feel that you've made progress, that you're doing something that you've wanted to do. Now that you decided to do it, you feel that you don't have any illusions about what will come from it, is that it?"

T.: "That's right. I mean, it just seems to me that it would be very interesting. It makes life more interesting for me if I have something like that."

C.: "Sounds also as though that's something you decided for yourself—did by yourself. . . ."

T.: "I realize lately that when my mother wants me to go out with her, I find that I'm not too happy to go with her, it's just her personality that I don't like. Now I realize that mine isn't what it should be but then I don't enjoy hers either, and it's sort of a guilty feeling, too."

C.: "You feel that in some very real ways—you just don't like your mother particularly well, and it bothers you that you should feel that way."

T.: "That's right, because I know it's wrong, because I know she has done so much for me, and yet—I think, well, maybe she hasn't done so much for me—she was trying to merge herself in her children—actually she did it too much, though. She was just escaping, I guess. . . ."

"A girl I've been going with, a girl I've gotten to know—she's helped me a lot. . . . I always had ideas that were too high. I've always had a definite feeling of the kind of person I should be and now some of those thoughts are changing."

C.: "You feel that where you used to be trying for something way up high now it is different. . . ."

T.: "When you're in a family where your brother has gone to college and everybody has a good mind, I wonder if it is right to see that I am as I am and I can't achieve such things. I've always tried to be what others thought I should be, but now I'm wondering whether I shouldn't just see that I am what I am."

C.: "You feel that in the past you lived by others' standards and you are not sure just what is the right thing to do, but you're beginning to feel that the

best thing for you is simply to accept yourself as you are."

T.: "Yes. Of course, some people might say that that idea would block progress—that if you just accept yourself as you are, then you wouldn't get anywhere. Do you think that is right? Still, I've tried the other thing and I know that doesn't work."

C.: "You realize that some people might think your present attitude would keep you from moving ahead, but you know within yourself that you tried adopting standards that were not your own and that doesn't work. . . ."

T.: "Well, I guess that is so. I don't see what it is that has changed me so much. Yes, I do. These talks have helped a lot, and then the books that I've read. Well, I've just noticed such a difference. I find that when I feel things, even when I feel hate, I don't care. I don't mind. I feel more free somehow. I don't feel guilty about things."

Following the end of Miss Tilden's counseling sessions, she continued to hold her job and engage more actively in social affairs. Her improvement seemed beyond question in the ten months following the end of counseling. A follow-up interview a year later brought out the fact that Miss Tilden had a recurrence of her old feelings which seemed to be explained by the fact that she had recently been going with a boy who had seemed to look down on her as a person who lacked ability. Some weeks later, her mother reported that she had obtained a new job and seemed more cheerful and better adjusted.

In short, the client had made considerable progress in working out for herself a new understanding and acceptance of herself and hence a more satisfactory adjustment to life. This did not come suddenly and there were setbacks, but the overall progress was unmistakable. Note that the counselor did not at any time force the issue, nor did he introduce any new ideas. What he tried to do was to reflect and clarify the client's own feelings and attitudes in such a way that she could better understand herself. The counselor did not give advice or employ reassurance or moral exhortation. These are the cardinal rules for the client-centered therapist.

PSYCHOANALYSIS

Psychoanalysis is the theory of personality structure and the method of psychotherapy developed by Sigmund Freud. Although few

modern psychotherapists subscribe wholeheartedly to all of Freud's ideas. His teachings have profoundly influenced the development of most modern theories and techniques of therapy.

Psychoanalytic theory. Freud believed that when an individual represses certain thoughts and motives, they remain active at an unconscious level and continue to influence behavior in important ways. Using this idea of unconscious motivation as his point of departure, he developed an elaborate theory of personality structure.

Freud was strongly impressed by the frequency with which sexual problems seemed to be at the source of his patients' problems, and he came to believe that the fundamental source of energy underlying all human behavior stems from an instinctive drive—called the *libido*—which is sexual in nature. It is important to note that Freud used the term “sexual” in a very broad sense to refer to any type of physically pleasurable activity. Thus the libido would include all instinctive urges associated with bodily satisfactions.

Freudian theory divides the personality structure into three parts—the *id*, the *ego*, and the *superego*. In the methodology of modern psychology, these are logical constructs or intervening variables. Though they are less well defined than such constructs as “hunger,” “motivation,” or “drive”—and therefore must be used cautiously—they nevertheless have provided a convenient and systematic framework for studying certain psychological processes.

The *id* is the primitive part of the unconscious, the storehouse of the libido. Composed of instinctive organic cravings, the *id* is characterized by many unrestrained pleasure-seeking impulses which are constantly demanding expression.

The desires originating in the *id* are held under the conscious control of the *ego*. The *ego*, according to Freudian theory, is the rational aspect of the personality. It regulates the activities of the *id* and guides the organism's behavior to meet the demands of reality. The concern by the *ego* is with maintaining social approval and self-esteem. It controls expression of the *id*'s impulses according to their acceptability in the real world.

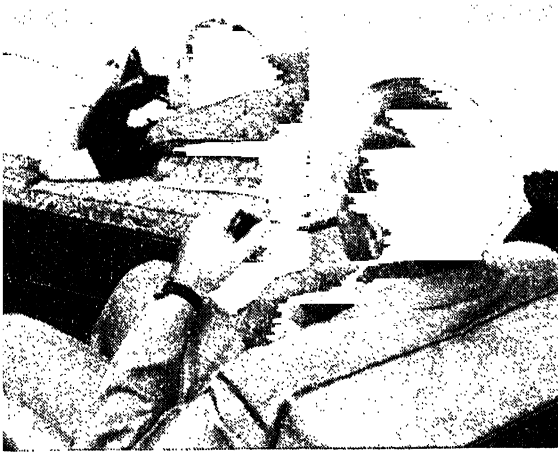
The individual's moral attitudes reside in the *superego*, which corresponds roughly to

the “conscience” and guards the uncompromising ideas of right and wrong which the individual learns as a child. The demands of the *superego* are in continual conflict with those of the *id*, and both seek expression through the *ego*. Thus caught between “the devil and the deep blue sea,” the *ego* usually resorts to some form of compromise mechanism, such as sublimation or compensation, which will at least partially satisfy both libido and conscience. Inability of the *ego* to make such a compromise usually leads to the appearance of neurotic symptoms, which Freud regarded as symbolic outlets for the frustrated impulses of the *id*.

Psychoanalytic theory attaches particular importance to the influence of the individual's childhood experiences on his ability to adjust in later life. If painful conflicts have been repressed in childhood without having been adequately resolved, they will continue—though unconscious—to influence the individual's thoughts, feelings, and behavior, causing emotional tension and inability to adjust.

Psychoanalytic therapy. Psychoanalytic therapy is an intensive and prolonged technique for exploring the patient's unconscious motivation. Its aim is to bring to consciousness whatever painful memories and conflicts are causing the patient's difficulties and to help him resolve these conflicts in the light of adult reality. Such a process presumably effects a radical change in the individual's basic personality structure. Psychoanalysts use several techniques for bringing repressed conflicts to consciousness and helping the patient to solve them. They include free association, dream analysis, analysis of resistance, and analysis of transference. We shall discuss each of these techniques in turn.

Free association. The principal procedure used in psychoanalysis to probe the unconscious and release repressed material is free association. The patient sits comfortably in a chair or lies in a relaxed position on a couch and lets his mind wander freely, giving a running account of his thoughts, wishes, physical sensations, and mental images as they occur. He is encouraged to reveal his every thought, regardless of how personal, painful, or seemingly unimportant. The therapist often occupies a position behind the client, where he will not serve as a distraction or disrupt the flow of association.



In psychoanalysis the client achieves a good deal of catharsis by talking about whatever occurs to him, but, in contrast to the nondirective counselor, the therapist exercises authority and interprets the meaning of what his client expresses.

Although considerable catharsis is achieved in this "talking out" process, psychoanalysis is not fundamentally a client-centered technique. Rather, emphasis is placed on the authority of the therapist, who interprets to the patient the meaning of the thoughts, wishes, and attitudes expressed in the free association. As the stream of consciousness reaches deeper and deeper into the unconscious, the repressed urges which are uncovered often reveal themselves in disguised and symbolic form. The analyst uses his training and experience to remove the disguises from the subject's revelations and thus explain their real significance.

Dream analysis. Psychoanalytic therapists gain further insight into the patient's unconscious motivation by the technique of dream analysis. Freudian psychologists believe that the primary function of most dreams is to satisfy unfulfilled desires or wishes. Presumably, when the individual is asleep, his ego is less on guard against the unacceptable impulses originating in the id, so that a motive which cannot be expressed in waking life may find expression in a dream. Some motives are so unacceptable to the conscious self, however, that they cannot be revealed openly even in dreams but must be expressed in disguised or symbolic form. Thus a dream has two parts, or contents. The *manifest* (openly visible) content of the dream is that which we remember and report upon awakening. It usually is not painful and, in fact, often

seems quite amusing. Beneath the manifest content is the *latent* (hidden) content—the actual motives which are seeking expression but which are so painful that we do not want to recognize their existence. A trained therapist can often uncover these hidden motives by studying the symbols which appear in the manifest content of the dream and finding out what particular meaning they have for the dreamer.

The unconscious process which transforms the emotionally painful latent content of the dream into the less painful manifest content is called *dream work*. Dream work distorts the content of a dream in various ways so that the motives expressed in it will be less obvious to the dreamer. For example, a student who is full of anxiety about failing an examination and being expelled from school may express his fear symbolically by dreaming that he is pushing his way through a heavy snowstorm, pursued by wild animals. Or, with rather less disguise, a woman who feels hostility toward her husband might dream of killing a rat—the significance of this symbol being revealed by her often referring to her husband as "the little rat."

In analyzing the meaning of the patient's dream, the analyst uses the technique of free association. Taking the manifest content of the dream as the point of departure, the analyst gradually uncovers the latent content and interprets its meaning to the patient. Skilled therapists who are familiar with the kinds of distortion created by dream work are frequently able to locate a conflict of which the patient is not aware.

Resistances. During the process of free association, the patient often shows resistances—that is, inability or unwillingness to discuss certain ideas, desires, or experiences. Resistances prevent the return to consciousness of repressed material which is painful to recall, such as material connected with the individual's sexual life or with hostile, resentful feelings toward his parents.

The psychoanalyst attaches particular importance to subjects which the patient does *not* wish to discuss, believing that they are most closely related to the repressed experiences that are causing his present difficulties. The aim of psychoanalysis is to break down resistances and bring the patient to face these painful ideas, desires, and experiences. Analysts maintain that if the patient is not con-

sciously aware of certain problems, he obviously cannot solve them. Breaking down resistances is a long and difficult process but is considered absolutely essential to successful psychoanalytic therapy.

Transference. During the course of psychoanalytic treatment, the patient usually develops an emotional reaction toward the therapist, identifying him with some person who has been at the center of an emotional conflict in the past. This phase of therapy is known as transference. In most cases the analyst is identified with a parent or lover. The transference is called *positive transference* when the feelings attached to the therapist are those of love or admiration and *negative transference* when they consist of hostility or envy. Often the patient's attitude is *ambivalent*—that is, he experiences both positive and negative feelings toward the therapist, as children often do toward their parents.

The analyst's task in handling the transference is a difficult and dangerous one because of the patient's emotional involvement, but it is a crucial part of treatment. The therapist helps the patient to interpret the transferred feelings and to understand how they have their source in earlier experiences and attitudes. According to psychoanalytic theory, this is a basic technique in bringing the patient to face his conflicts.

Criticisms of psychoanalytic theory. Freud continued to refine and defend his system until his death in 1939. Because psychoanalysis has been widely used and is more time-consuming and expensive for the patient than other forms of psychotherapy, it has been more extensively discussed—and, in some quarters, more violently criticized—than have the others. Even Freud's most severe critics, however, acknowledge certain of his contributions to the development of modern psychology and psychiatry.

1. Freud emphasized the importance of unconscious processes in determining human behavior.
2. Although most modern therapists believe that Freud overemphasized the role of sexual factors, psychoanalysis "broke the ice" in the scientific study of sexuality and indicated its importance as a source of adjustment problems.
3. Psychoanalysis focused attention on the importance of childhood experiences in later personality development and adjustment.

In view of these significant contributions, Freud is generally considered the most influential figure in the rise of modern psychotherapy. Nevertheless, certain difficulties with his system have led some therapists to adopt a radical modification of orthodox psychoanalysis and other therapists to reject the method entirely. Most recent workers in the field of psychotherapy feel, for example, that Freud placed too much emphasis on the periods of infancy and childhood. They also believe that a cure cannot be effected simply by helping the patient understand his unconscious feelings but rather that the patient must be *directed* along the path of changing himself and his inadequate modes of adjustment.

The most controversial aspect of psychoanalytic theory, and the point most vulnerable to attack, is Freud's assumption that man's emotional problems are products of a conflict between his instincts and the censoring action of the ego and superego. Many modern psychoanalysts—who might be described as "neo-Freudians"—maintain that man's struggles with his *cultural environment* as well as with his biological cravings are responsible for his emotional disturbances and that therapy must therefore be aimed at understanding the patient's present situation as well as his past experiences. This approach is typified in the popular writings of Karen Horney, an American psychoanalyst who led the revolt against Freud to such a point that it is doubtful whether she could fairly be classed as a Freudian. She protested, however, that she was modifying an old system, not creating a new one (Horney, 1945).

From a practical standpoint, psychoanalysis has also been criticized on the grounds that it requires a great deal of the patient's time and money. It must be remembered, however, that psychoanalysis aims to create a fundamental and permanent alteration in the individual's personality structure. To achieve this goal at least two or three years of frequent sessions with the analyst are usually necessary.

Even when the individual can afford to spend the time and money necessary for a complete course of analytic treatment, the results are not always satisfactory. The following reasons have been cited as the primary cause of failures in psychoanalytic treatment: (1) the analyst's difficulty in applying psy-

choanalytic techniques because of his lack of ability or training, (2) environmental conditions which interfere with the patient's attempts to readjust, and (3) application of psychoanalytic techniques in cases which are too severe to be handled by this method alone (Oberndorf, 1950).

Psychoanalysis is not as yet a complete system, and it can be expected that its effectiveness will be improved as further experience in working with neurotics yields modifications and extensions of its basic concepts. Because psychoanalysis relies heavily upon the patient's achieving great personal insight, it is best adapted to individuals who are above average in intelligence and who are not seriously mentally ill. Although psychoanalytic principles have permeated all psychotherapy, *orthodox* Freudian analysis is not in common usage today.

EVALUATING PSYCHOTHERAPY

Recently an experiment was attempted to evaluate objectively the relative effectiveness of various kinds of therapy. Some therapists have contended that helping the patient recognize only his surface feelings will bring about improvement, whereas those more influenced by Freud contend that better results are achieved when deeper feelings are probed.

Insight or self-understanding was selected as the criterion for improvement and was defined as the correctness with which a patient perceived his own behavior, motivation, feelings, or attitudes. Two groups of subjects were matched as nearly as possible on such variables as acceptance, permissiveness, understanding, and motivation. In the "surface group" the therapist attempted to recognize explicit feelings and in the "deep group," implicit feelings.

According to the clients' reported evaluation of results, the deep group felt the sessions were from moderately to quite beneficial, whereas the surface group felt the sessions were from slightly to moderately beneficial. Subjects in the deep group gained significantly in emotional insight, whereas those in the surface group did not. Taken as a whole, the evidence tended to confirm that greater insight is achieved when the therapist recognizes implicit as well as explicit feelings in his clients. This study has certain limitations due to the difficulty of holding all dependent variables constant but lends strong

support to the contention that psychotherapy can be studied objectively and experimentally (Grossman, 1952).

Many academic psychologists have been critical of Freud's teachings—as well as of other theories of psychotherapy—on the grounds that they were derived from clinical findings rather than from laboratory experiments. Such critics agree that psychoanalysis sometimes works, but they want to know *why* it works. Overall evaluation of therapeutic results from psychoanalysis offers many difficulties; hence there are not as many follow-up studies as could be wished. One difficulty is that even doctors evaluate the same results in different ways. For instance, to what extent does the alleviation of a symptom constitute a cure? Many studies are needed to establish the validity of psychoanalysis and other theories of therapy and to help bring clinically derived concepts into the realm of science.

In one such study a psychoanalyst examined twenty-eight patients treated eight to twenty-four years previously. These twenty-eight cases were all chronic neurotics who underwent treatment for an average period of two years and three months. The investigator held that the success or nonsuccess of psychoanalytic therapy could best be judged some time after the end of the analysis, since the changing effects in personality usually emerge gradually. The aim of this study was to evaluate only lasting personality change—as determined by the reports of the patients themselves, the judgment of the analyst, and judgments made by objective observers some time after the end of treatment.

The most lasting personality changes reported by the patients were in interpersonal relationships. Twenty-five of the twenty-eight subjects stated that analysis had made a permanent change for the better in their ability to get along with people and to feel more at ease. None found it more difficult. In twenty-two cases there was a lasting change in ability to work and to enjoy work; none of the patients reported any lessening of this ability after analysis. Fourteen cases reported a decided improvement in the ability to enjoy life. Fifteen patients stated that they had achieved a lasting improvement in sexual adjustment. In this regard it was noted that, contrary to popular opinion, the removal of neurotic sexual inhibition did not lead patients to disregard necessary social restraints on sexuality but rather freed them from the compelling role of

sex as a motive power. Twelve of the twenty-eight patients reported a lasting change in their perception of reality, in such words as: "a different way of perceiving"; "a richer gamut of experience"; "I have come out of a fog."

It was found that analysis had a marked effect on personality even in the cases where symptoms did not change to any extent. The patients held uniformly positive attitudes toward analysis as a treatment—despite the fact that analysis may always seem something of a disappointment, since patients tend to expect unrealistic "miracles."

In this study the psychoanalyst's own evaluation of results were: 7 cases, very satisfactory; 15 cases, satisfactory; 2 cases, unsatisfactory; and 4 cases doubtful. The patients' evaluations were: 10 considered results as very satisfactory; 3 considered results as between very satisfactory and satisfactory; 12 considered results as satisfactory; 2 gave indefinite replies; and 1 stated that, in regard to his homosexuality, results were unsatisfactory, but that otherwise results were satisfactory (Schjelderup, 1955).

Since therapeutic gains have been achieved by a wide range of methods, one psychologist has attempted to isolate those factors that seem to be common to *all* methods of therapy (Shoben, 1953).

The characteristics of successful psychotherapy, as seen by this investigator, are: (1) The clinical worker shows a genuine concern for his client. (2) The therapist establishes an atmosphere of *non-retaliatory permissiveness*. The client is not punished or rejected for what he says. (3) The relationship between therapist and client is one of *honesty and understanding*. The clinician helps the client to interpret or clarify his feelings and reactions. He tempers his permissiveness by awarding approval to the client for his efforts to think more clearly about himself. (4) The relationship is *one-sided*, since the therapist does not share his own troubles, nor does he ordinarily intervene in the client's outside life. Both of these factors tend to minimize the therapist's own distinctive personality. (5) The content of conversation in the clinical situation is concerned with the client's *values, motives, and emotions*.

This investigator has also tried to analyze the essential characteristics of neurosis, as applying to persons who lack the interpersonal skills necessary for performing their social roles satisfactorily. His theory is that neurosis is essentially social in origin and that psychotherapy represents a special kind of secure

social situation in which the process of socialization can be reconstructed.

In the early sessions of therapy the patient learns how to think more clearly about himself. His hostile and suspicious attitudes are challenged by the therapist's consistent concern. Although the client during the course of therapy usually gains rational insight into his problems and learns to verbalize them, this apparently is not the crucial factor in determining the success of therapy. Rather, the therapeutic relationship itself seems to hold the answer. It affords the patient comfort, security, and hope at the same time that it probes the sources of his anxiety. One reason for the sometimes lengthy process of psychotherapy is that the patient is not ready to recognize his repressions until he builds up enough security to overcome the anxiety which recognition of his repressed feelings will produce.

The personal anonymity maintained by the clinician is another important factor in successful psychotherapy. It enables the patient to interact with the therapist not as a specific individual but rather as representative of "people in general." This fact, in turn, helps the patient carry over to his outside life the new understandings and patterns of thinking gained in the therapeutic situation.

In recent years many psychologists, using both animals and human subjects, have attempted to test the various postulates of psychotherapy. A recent and comprehensive work in this field has been carried out by an anthropologist and a psychologist working as a team to test the concepts of psychoanalysis and explain them in terms of modern learning theory (Dollard and Miller, 1950). For an attempt to integrate certain elements of both psychoanalysis and learning theory into a new formulation, see pages 539-542.

PHYSICAL METHODS OF THERAPY

The distinguishing feature of the psychiatrist—whatever theory of personality and psychotherapy he advocates—is his medical training. In the psychiatric treatment of severe emotional disturbances, particularly where there is considerable loss of contact with reality, various physical methods of therapy often

are combined with psychotherapy. Such medical measures range from the use of special diets to the application of chemical sedatives or the artificial induction of violent convulsions. It should be emphasized that the function of such "physical psychiatry" is not primarily to cure the individual's emotional disorder but to prevent some extreme act such as homicide or suicide and, at the same time, to make the disturbed patient more receptive to psychotherapy. Most physical methods are thus best considered *adjuncts* to psychotherapy. The most prominent of these methods are shock therapy, narcosis, chemotherapy, and brain surgery.

SHOCK THERAPY

During the past twenty years remarkable progress has been made in treating severely disturbed patients by inducing artificial epileptic seizures or convulsions. Such treatment, known as *shock therapy*, is now routine in most mental hospitals. Although a number of different techniques can be used in shock therapy, a common feature is that they all leave the patient in a state of coma for from several minutes to several hours after shock has been induced. It is not entirely clear,

This patient receiving electro-shock is held firmly by the nurses and attendants while the current passes through the electrodes applied to her head. Afterwards she will be more responsive to psychotherapy than before, and with successive treatments her period of reasonableness may gradually increase until finally there is no relapse at all. Twenty, thirty, or more such treatments may be required, although in some cases fewer are needed.



however, whether the coma itself is the therapeutic factor or whether the value of shock is due to some other factor—such as physiological changes produced in the nervous system or the creation of a violent psychological reaction (Noyes, 1948). As yet, shock treatment is used on a purely *empirical* basis: that is, experience shows that it does have therapeutic value, but no generally accepted theory has been established to explain why. No one really knows what changes—physiological or psychological—occur during the shock and the ensuing period of unconsciousness.

Insulin shock. One of the oldest forms of shock therapy involves the administration of *insulin*, which produces a prolonged coma by reducing the sugar content of the blood and thus depressing metabolic processes in the brain (Sakel, 1937). This method has been especially effective in treating schizophrenia. Immediately upon emerging from the insulin coma, the patient generally shows remarkable improvement and appears to be in good contact with reality. This "lucid" period lasts for only about an hour and is usually used for a valuable session of psychotherapy. As this combined use of insulin shock and psychotherapy is continued, the patient often becomes free from his symptoms for longer and longer periods of time and may eventually show complete recovery. It has been estimated that in the treatment of schizophrenic patients this combination of insulin shock and psychotherapy produces some degree of lasting improvement in approximately 45 per cent of cases (Jessner and Ryan, 1941).

Metrazol therapy. Another form of shock therapy, seldom used today, is the induction of violent convulsions by injecting the patient with the drug *metrazol*. Within several seconds after the injection the individual experiences a severe epileptic seizure, followed by unconsciousness. Although this method has produced considerable improvement in a large percentage of cases, it has serious drawbacks which have led most psychiatrists to abandon it. One complication of metrazol therapy is the danger of broken bones and other injuries as a result of the convulsive spasms. However, the greatest objection is the extreme fear—"a feeling of impending death and sudden annihilation"—which the patient experiences in the few moments of consciousness preceding the onset of the convulsion (Kalinowsky and Hoch, 1952).

Electro-shock. The most recently developed and by far the most widely used form of convulsive therapy is *electro-shock*. The idea of curing diseases by electrical discharges is no modern innovation but was used by the ancient Greeks, who treated headaches and other pains by applying a live torpedo fish (which has a discharge of 25 to 30 volts) to the head of the sufferer (Cerletti, 1950). Electro-shock therapy, however, was introduced in Europe as recently as 1938 (Cerletti and Bini, 1938) and was not used in the United States until 1940.

During treatment the patient is placed on a bed and securely padded to prevent injury during the convulsion. Electrodes are then fastened to the head, and a current ranging from 70 to 130 volts is applied to the head for a fraction of a second. This type of treatment is generally preferred to shock therapies which depend upon drugs. In the first place, the loss of consciousness in electro-shock is immediate, so that the patient does not develop the "panic" common in metrazol therapy. Moreover, there are seldom any complicating aftereffects or injuries due to the electrically induced convulsion.

Electro-shock has proved particularly effective in cases of severe depression. It has been valuable in saving patients who might otherwise commit suicide, and it usually alleviates feelings of guilt and self-accusation (Noyes, 1948).

Because the tendency to self-accusation usually disappears following a series of electro-shock treatments, many authorities have proposed that the chief value of the method is psychological rather than physical—that the patient who has strong guilt feelings regards the shock as a form of punishment and thus an atonement for his "sins." Other psychiatrists, however, point to the possibility of physical effects of the convulsion on the nervous system. The issue remains in doubt. Nevertheless, like the other shock therapies, electro-shock is used primarily to alleviate severe symptoms and must usually be accompanied by psychotherapy for a permanent cure.

NARCOSIS

Narcosis (from a Greek word meaning "stupor") is a technique which uses sleep-producing drugs, including sodium amytal,

sodium pentothal, and scopolamine. This type of therapy takes two forms: prolonged narcosis and narcoanalysis.

Prolonged narcosis. In prolonged narcosis the patient is kept asleep under the influence of drugs for fifteen or more hours a day during a period of one to two weeks. Although an apparently simple type of treatment, prolonged narcosis is actually quite difficult and dangerous to administer, and the patient must be kept under constant observation while he sleeps. Since a number of physiological complications are liable to develop under prolonged sleep, the technique is seldom used today, although it was quite popular before the development of the various shock therapies.

In present-day practice prolonged narcosis is used primarily as an emergency measure to quiet severely agitated patients. Its main effect, apparently, is purely sedative and temporary, and it is a much more severe form of treatment than its results usually justify.

Narcoanalysis. Considerably greater success has been reported with narcosis in its brief form, known as "narcoanalysis." In this method drugs such as sodium amytal are given in amounts sufficient to cause "grogginess" but not deep unconsciousness—the patient remains in a state of "twilight sleep." The method is frequently used as a substitute for hypnosis because it can be induced faster and more easily than a deep hypnotic trance.

By direct suggestion, the patient under narcoanalysis is encouraged to talk about or act out his painful experiences. Once exposed by this method, repressed emotions are better understood and may be accepted by the patient. Because the individual is in a state of semisleep, however, his revelations often mix fact with fantasy and, like dreams, require the therapist's interpretation. For this reason, sodium amytal—popularly publicized as a "truth serum"—actually has no value in legal investigation except as a means of "turning up leads." It can not be used as direct evidence (Redlich, Ravitz, and Dession, 1951).

Narcoanalysis is most effective when employed soon after symptoms of repressed emotional tensions appear. It has proved particularly successful in the rapid treatment of the emotional tensions produced by combat and the frustrations of military life (Horsley, 1944; Grinker and Spiegel, 1945). The following case is typical.

"A 22-year-old male of stable rural background completed high school at 17 and farmed until inducted at 21. Although 'bothered' by the noise and concussion of his ship's guns, he had no symptoms until his ship was attacked by a number of enemy suicide planes, four or five of which actually dived into his ship. On admission patient was dazed, confused, mute, and seemed to be deaf and unable to read or comprehend written questions. The first pentothal interview, about 18 hours after his ship was hit, was unproductive except for showing that patient was neither deaf nor mute. He muttered something about a "cheap drunk" but seemed too exhausted to respond further. Afterwards he was as dazed, confused, and unresponsive as before. A second pentothal interview, two days later, led to free verbalization, but without remarkable affective display. He appeared apprehensive, rubbed his left elbow, and was restless. He described the separate attacks of four suicide planes while he was at his gun station. He fretted over the loss of his gun loader and feared the gun firing above him as much as the enemy. As the effect of the

pentothal wore off he continued to talk freely. After two days he remained animated and symptom-free except for slight dizziness with sudden changes of position. He recalled that one plane hit near his battle station, and it may be assumed that he suffered some blast concussion" (Orr, 1949).

Narcoanalysis is usually followed by physical rest, elaborate reassurance, and a program of recreation, as the patient gradually readjusts to the demands of reality.

CHEMOTHERAPY

Within the past few years, psychiatrists have reported considerable success in the use of new "wonder drugs" for treating mentally ill and emotionally disturbed persons. Experience with these drugs is still too limited for us to regard them as a panacea for the treatment of all mental illness, but the outlook is heartening.

One of the most widely tested drugs is *Rauwolfia*. It comes from the root of the Indian plant *Rauwolfia* (or snakeroot), whose medical properties have been recognized in India for thousands of years. Research on this root was begun in 1931, but it was not until 1952 that the ingredient *reserpine* was isolated.

Narcoanalysis has been very effective in treating tensions produced by combat. The soldier (left) is suffering from hysterical lameness, resulting from his repression of painful memories. In the psychiatrist's office (center) he is injected with a barbiturate drug which, before putting him to sleep, allows him to pour out the unpleasant experiences. After the drug has worn off, the psychiatrist reviews the interview with the patient and encourages him to try walking. A few days later he is well enough to play baseball.



Clinical use of reserpine began after it was discovered that the drug was of value in treating hypertension (high blood pressure) and that it also had a calming influence on patients (Ciba, 1954).

One investigation found that this drug made patients less anxious, more outgoing, less inhibited, and more talkative during psychotherapy. In the cases studied, restless patients became more relaxed, and in several cases insulin shock was considered unnecessary after the drug had been used. Patients reported that dreams became more vivid and easily remembered. There were side effects of drowsiness, yet this drowsiness did not have the debilitating effect of barbiturates (Kline, 1954).

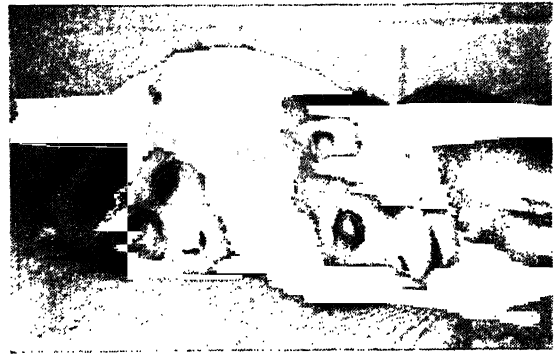
Other reports have confirmed the fact that in many cases reserpine diminishes tension and anxiety and makes patients more accessible to psychotherapy.

Another drug, *chlorpromazine*, seems to give similar results and has been used with patients who do not respond to reserpine.

In one recent study sixty-six highly disturbed female patients were divided into two groups, one of which received chlorpromazine for a period of twelve weeks. The other group, used as controls, were led to believe they were being given a drug but actually received inert material. The experimental and control groups were equated not only on such factors as diagnosis, age, and length of hospitalization but also in terms of their ratings on the L-M Fergus Falls Behavior Rating Scale, administered before the experiment began.

The group receiving chlorpromazine began showing improvement immediately, and by the end of four weeks they were significantly better than the controls. This superiority was maintained throughout the medication period and for four weeks afterward. The experimental group showed improvement in all areas of behavior, including working behavior, eating behavior, and behavior toward other patients and hospital personnel. The group receiving inert material, on the other hand, showed no changes except some improvement in behavior toward professional personnel and a decline in verbal misbehavior (Sommerness *et al.*, 1957).

Further research is needed to discover how permanent the effects of chlorpromazine may be. However, at the time the above experiment was published, five of the patients who had received the drug—as compared to only



Reserpine given the monkey on the left leaves him calm but alert, while his companion is unconscious from a barbiturate. By diminishing tension and anxiety, reserpine makes many patients more accessible to psychotherapy. However, experiments are still being made with the tranquilizing drugs to discover more about their uses, how they work, and what side-effects and aftereffects they may have.

two controls—had been transferred to better wards of the hospital. Two of these five were to be discharged shortly.

Since the introduction of tranquilizing drugs, discharge rates in most mental hospitals have risen steadily. In New York State, for example, there was a 23 per cent increase in discharges between April 1955 and April 1956, due largely to new drug treatments (National Health Education Committee, 1957). A 1955 symposium on the use of chlorpromazine and reserpine reached the following conclusions.

The pooled experience of use of these two drugs in approximately four thousand cases of various psychiatric disorders gave, in general, encouraging results. Pharmacologically, there is a great deal to learn in regard to dosages, specific indications, and possible complications. Psychiatrically, there is general agreement that these drugs help relieve psychomotor overactivity and agitation without distorting the patient's basic thinking or feeling processes and without altering his ego structure. The drugs have great potential value in easing the establishment of psychotherapeutic relationships and helping the psychotherapy process (Pearson, 1955).

One of the newer drugs, known as *Miltown*, is effective primarily in reducing anxiety and relaxing tensions (Borrus, 1955). One study showed that as many as 90 to 95 per cent of neurotic patients either recovered from or were somewhat relieved of their feelings

of tension after taking this drug (Selling, 1955). However, psychotic patients were not greatly benefited in most cases.

Mescaline and *lysergic acid diethylamide* (LSD), discussed on page 198 as drugs which can *bring on* mental disease symptoms, have also been used in therapy. Among the principal value of these drugs is that patients under their influence often regress to childhood experiences and are able to recall past events which may have helped cause their emotional disturbance. One physician who treated ninety patients with LSD over a period of two years reported that 50 per cent recovered and remained normal, whereas only 12 per cent failed to show improvement. The rest improved in varying degrees. Best results were usually obtained with patients suffering from obsessive behavior (Sandison, 1956).

PSYCHOSURGERY

Among the most dramatic and widely publicized innovations in modern psychiatry are the recently developed techniques of brain surgery used in the treatment of severe emotional disorders (Moniz, 1937; Freeman and Watts, 1942). The best known form of psychosurgery is the *prefrontal lobotomy*, an operation in which the nerve fibers connecting the prefrontal lobes of the brain with the hypothalamus are severed. The prefrontal lobes are the most highly developed area of the brain and are believed to be very important in higher thought processes; the hypothalamus is an important center of emotion (See pages 503-504). It is assumed, therefore, that cutting the fibers between these two areas should

"sever the pathway between emotion and imagination" (Noyes, 1948). Thus a lobotomy presumably serves to diminish the emotional tone accompanying the individual's thoughts and memories. This de-emotionalization is illustrated in the following case reported by a prominent psychiatrist.

"In one of my patients, a woman thirty-five years old, the voices were so insulting and deriding and accused her of such 'horrible and beastly' sex practices that she was constantly in a state of desperate panic. Three nurses were needed to prevent her from gouging out her eardrums with anything she could lay her hands on and she frequently attacked the nurses with homicidal intent.

"The operation, done more than six years ago, was remarkably successful. She is so much better that two years ago her family took the necessary legal steps to reinstate her in charge of her financial affairs. Yet she still hears 'voices,' although I doubt whether any of her friends know it. Occasionally, I encounter her in a public restaurant and watching intently, now and then I can see her lips moving silently—answering 'voices.' But the people with whom she is lunching suspect naught of this. She is carrying on gay and sprightly conversation with them. The 'voices' have become insignificant. The operation has torn them loose from the emotional matrix in which they were once so deeply imbedded" (Strecker, 1952).

Thus psychosurgery does not necessarily remove the sources of the patient's disturbance, but it can release him from the emotional torment wrought by disturbing thoughts and ideas.

A major disadvantage of lobotomy is that it often results in profound personality changes. Although his intelligence (as measured by standard tests) may not be affected noticeably, the patient may display considerable loss in creative imagination. There is a generalized shallowing of emotionality: the individual's emotional behavior is childish and lacking in depth. Although his memory may be unimpaired, he is apt to be uninterested in the past; he is concerned only with the "here and now" and has few goals which extend to even the immediate future. In general the lobotomy patient may be described as lacking "self-continuity"; that is, he loses the feeling that he is the same person he was yesterday and will be tomorrow (Robinson, Freeman, and Watts, 1954).



The pictures above show the same woman before (left) and after (right) transorbital lobotomy.

Much research is needed before the final evaluation of prefrontal lobotomy can be made—before the potential gains can adequately be balanced against the risks. One extensive and well-controlled study recently was made of forty-four seriously disturbed patients in a veteran's hospital. Twenty-two of them underwent prefrontal lobotomy. The other twenty-two served as a control group, having been equated as nearly as possible with the experimental group in age, sex, education, diagnosis, ability to cooperate, and length of hospitalization. All subjects were given a very extensive battery of psychological tests before the operations and again two weeks, three months, and one year afterwards. Four clear conclusions emerged from this study (Scherer *et al.*, 1953).

1. Performance on tests measuring mental efficiency drops sharply during the two-week period following the operation. At the third month the tested performance rises to a point usually a little above the preoperative level; by the end of the first postoperative year some of the performances fall off to a point slightly below the preoperative level.
2. There is better contact with the environment after the operation, as shown by the increased ability of the patients to differentiate between the self and the nonself. This is highest at three months following the operation, but not all of it is lost by the end of the first year.
3. There is an increase in speed of motor action after the operation. This, too, is highest at three months, but is not all lost by the end of the first year. Postoperative patients, though faster, are not more accurate in their responses. They are more impulsive, less concerned with the future, and more capable of antisocial thought and action.
4. For at least three months there is increased interest in sex. Later, sexual interest seems to be overshadowed by anxiety over biological survival and fear of castration.

Although the lobotomy may bring striking improvement in cases where all other methods of therapy have failed, it is used very sparingly because of the drastic aftereffects which sometimes follow the operation. It has been proposed that *all* the following criteria should be met before a lobotomy is performed (Strecker, 1952).

1. The patient's illness should be chronic, both by diagnosis and by the fact of long duration.

2. The operation should be performed only if all other methods of therapy have failed, including insulin shock and electro-shock and, above all, thorough psychotherapy.
3. There should be no bodily or brain contraindications which would make surgery inadvisable.
4. A lobotomy should not be performed unless the patient's symptoms are extreme—impulsive, aggressive, and homicidal, with compelling hallucinations.

In other words, psychosurgery is indicated only in apparently "hopeless" cases where the individual's behavior is violently disturbed and all other methods of therapy, both physical and psychological, have failed. In many cases the standard lobotomy is being replaced by less extensive brain operations. Many of these have proved effective and at the same time seem to be less damaging to the personality (Freeman, 1953). Recent advances in chemotherapy have drastically reduced the use of all types of psychosurgery.

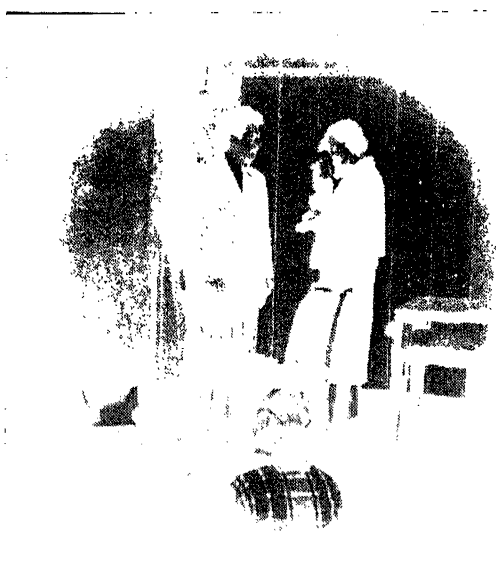
SPECIAL TECHNIQUES OF THERAPY

There are several special techniques which may be employed by psychologists, psychoanalysts, or psychiatrists. They are used with many variations by different therapists and have proved successful adjuncts to both directive and nondirective methods of psychotherapy.

PSYCHODRAMA

The psychodrama aims at a direct expression of the patient's emotional disturbance, as he is encouraged to act out various life situations which are related to his difficulties. The theaterlike atmosphere of psychodrama enables the individual to face his problems with less emotional tension than in real life (Moreno, 1946).

At the beginning of the session the therapist helps the patient outline the general situation to be enacted. Supporting roles in the drama are assigned to specially trained assistants. Once the scene is set, the patient plays his role spontaneously with the aid of the assistants who help him "live" the situa-



A young man brings his fiancée to a psychodrama session because of many interpersonal conflicts which they are unable to solve. Another woman interacts with him to show his fiancée, as in a mirror, how she behaves when they have an argument and how he resents her way of attempting to resolve the conflict by bursting into tears.

tion realistically. The following case of a thirty-year-old soldier suffering from "combat exhaustion" illustrates the use of this method (Fantel, 1946).

"Present illness: Patient states he has been hearing voices for the past six weeks. The voices moan and groan, but he cannot make out what they say. 'It is the guy I killed. I see him too.' The patient was referring to an incident about six weeks previously when he had been on guard duty on the Rhine.

"A German soldier tried to come upon the bridge guarded by the patient, who had to shoot him. Although hit twice in the chest, the German tried to get to his feet. Another American soldier on guard with the patient shot him down. The patient said that although he had killed six men in combat, this was the only one that bothered his conscience.

"Psychodrama: The crucial scene in which the patient had killed the German was recreated with much realism. A ward man played the role of the German soldier, crouching and approaching the patient, and after having been 'shot,' writhed on the floor—moaned and groaned. The patient said, 'Please don't do that. That is how he looked when

he died. I can see him in my sleep, on guard, or whenever I am alone. I sit down and wonder if that man will ever get off my mind. . . . He never talks, but just moans and groans.'

"The ward man got up, walking in front of the patient who shut his eyes. After the session was over, the patient was breathing hard and was very much affected. The same episode was repeated on several successive days and the patient gradually lost his fears. He was constantly afraid of finding bodies in the hospital, say, in the basement under the ward. So we initiated a program of training to familiarize him with dead bodies. We acted out several scenes in which an assistant played the 'body,' making the patient touch the body, handle it, turn it around, etc. At one time the patient was placed in the role of an undertaker. At first he showed great reluctance to touch the 'body' but we pointed out to him that he was only an actor. In time the patient overcame his fear of the dead, and thus received beneficial training."

By acting out his emotional disturbances in the psychodrama, the patient is afforded a rich opportunity for *catharsis*—he is free to express his fears and inhibited desires spontaneously in an atmosphere which simulates real life but which does not bear all the physical and psychological threats of real life. In this atmosphere of security he not only is able to gain increased understanding of his own emotional problem but also has an opportunity to gain new adjustment skills which can be carried over to real-life situations.

GROUP THERAPY

In recent years many efforts have been made to work therapeutically with groups as well as individuals. The greatest amount of experimenting in this area is probably being done by the psychologists, who have worked with groups of students with common problems, groups of employees who have similar difficulties, mothers who are concerned about their relationships with their children, and other groups who share common problems in personal adjustment. Group therapy is most often carried on nondirectively, although different therapists direct and guide the group's discussions in varying degrees. Regardless of its orientation, however, the group situation itself has been observed in every case to have a noticeable therapeutic effect upon the in-

dividual members. The benefits may range from the simple "misery loves company" type of reassurance to a deeper and more lasting personality change within the individual members.

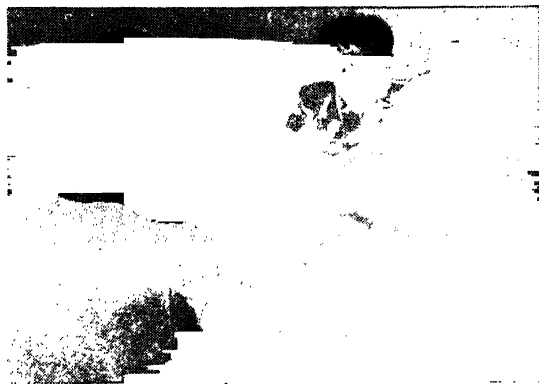
PLAY THERAPY

Play therapy is aimed at releasing pent-up emotionality through the use of various *play techniques* which give the patient a means of expressing his repressed frustrations. This type of therapy is often used in the treatment of behavior problems in young children. As the child plays with clay, dolls, drawing materials, and other toys in the permissive climate of the therapist's office, he may express deep emotional problems which are at the heart of his behavior difficulties. By working these out in play, he may arrive at new solutions and develop new adjustment skills. These play sessions also provide the counselor with clues that help him guide the parents toward an understanding of the child's problem.

During a therapy session the child plays spontaneously with little guidance or interference from the counselor. In doll play, for example, the therapist merely provides the child with a furnished doll house and a "family" of dolls. The child is encouraged to play with the dolls in any way he likes and is told that he can make them do anything he wants. In general, the situations created by the child are based on his own family experiences. But in contrast to real life, the child now finds himself in control of the family situation and



This child is going through play therapy in the office of Dr. Hyman Miller and Dr. Dorothy Baruch. Under the watchful eye of his psychotherapist, Iris Garff Rasmussen, he has painted his brother's picture and is pelting it with clay bombs. This, among other procedures, helped him to work through the jealous, hostile feelings that were producing serious behavior problems. After a time he no longer set fires, got along better at home, and moved from a slow reading group to advanced achievement. In her book *One Little Boy* (Baruch, 1952) Dr. Baruch shows in detail how clay, paints, and other materials help children to play out emotional conflicts and achieve happier, healthier adjustment.



The five preadolescent boys above are in a group therapy session at the Kansas Boys Industrial School.

so is able to change the characters' actions in such a way as to satisfy his own unfulfilled desires (Sears, 1951). Thus he may punish or even mutilate a doll which he has identified as a parent or sibling toward whom he feels hostility and resentment. Or he may represent himself as receiving wanted affection in the loving arms of his mother. Play therapy, in other words, permits the child to "act out" his emotional problems without fear of punishment or rebuff.

Vera hated the new baby for whose arrival she had not been adequately prepared. She also felt a great deal of hostility toward her family for neglecting her in favor of the newcomer. In the following dialogue, recorded verbatim during play therapy sessions, her feelings are apparent. Note that the therapist sympathetically accepts all Vera's

resentful feelings and that Vera regards the therapist as an ally with whom she is willing to share:

V.: (Picks up group of family dolls.) "Bang. Bang-bang . . . There. I'm gonna shoot the baby. They're Indians. I'm an Indian."

T.: "You're going to shoot them?"

V.: "Yeah. Bang. Shoot her. All of them. But I'm not going to shoot the furniture, 'cause I need those furnitures. . . ."

T.: "You need it so much you'll shoot them to get it?"

V.: "Yes. Bang-bang. I'm gonna shoot her right in the butt."

T.: "So angry, you shot her right in the butt."

V.: "Yes. I shot them all. There I got one. There. I got another. There. I got another."

T.: "You're getting all of them."

V.: "Yes. I'm getting all of them. Won't that be fun? Then you can have some and I'll have some. . . . We could keep the baby for eating. Okay? We'll keep the whole family so we can eat them all up. Okay?"

T.: "So we can eat them all up?"

V.: "Yes. We'll eat the daddy. Here. Here. We're hungry, aren't we? We love to eat things, don't we?"

T.: "We love to eat things?"

.....
V.: "Yes. We'll cut their panties, and we'll cut off their shirts, and cut off their hands and eat all of them up. You can eat this one and you can eat this one, and I'll eat the rest of them. . . . I'll cut off their heads with my knife."

T.: "You really are angry with them."

V.: "Sure. Cut, cut, cut, cut, cut. All coming off. Cut, cut, cut, cut, cut, cut. There. You're cut, you're cut. You're cut and you're cut and you're cut. Bad family."

T.: "You hate the bad family."

V.: "Yes. And I'll cut their feet, too, so they can't walk. Okay? Now we're all set. We've got everything to ourselves" (Moustakas, 1955).

The clinical psychologist may simply accept these expressions of the child's repressed and suppressed feelings, or he may go further and interpret them with the child—depending on the individual case and on the therapist. With or without such interpretation, children benefit from play therapy because it affords both an outlet for pent-up emotion and an opportunity to "experiment" with solutions to their problems.

Although play therapy is used primarily with children, a similar type of therapy which allows the patient to express himself through creative art has been used with some success

in the treatment of adults (Huntton, 1949). Activities such as painting and sculpture provide the adult patient with a means of discharging his negative feelings toward reality and of replacing them with the positive feelings of accomplishment. Sometimes this change is apparent in the sculpture or drawing. An example is the chapter opening picture, which is a symbolic self-portrait drawn by a schizophrenic girl.

HYPNOSIS

There is nothing mysterious about hypnosis. It is simply a highly suggestible state into which a willing subject is induced by a skilled operator. The methods of inducing hypnosis are too numerous to describe, but they all follow similar principles (Pattie, 1956). First, the subject places himself without mental reservation under the direction of the operator, who for best results should be trusted and respected. The operator starts by asking the subject to execute some simple act, such as lying down on a couch. Then the subject is told something which is obviously true—perhaps that the room is quiet and the lights are low. His confidence won, the subject is told a partial truth and is asked to execute acts which are only slightly out of the ordinary. For instance, he is told that his eyes burn and that his eyelids feel heavy. In a greater state of suggestibility, the subject may be led to believe the obviously untrue and to perform acts which he would not ordinarily think possible. All this time the operator is speaking in a monotonous tone of voice which lulls the patient into complete relaxation.

Hypnotic suggestion. Once the subject is well hypnotized, he can be given a wide variety of suggestions which he will readily accept. A hypnotized person cannot perform some physically impossible feat (such as floating through the air or lifting a thousand-pound weight)—although he can be made to believe that he is doing so. But, interestingly enough, the hypnotist can produce and banish at will many of the symptoms of hysteria, neurasthenia, anxiety neurosis, and related conditions. If the subject is told that he no longer feels pain in a particular member of the body, he will make no response to a needle prick or an electric current. He can be made temporarily blind or deaf, or he can be made to see and hear things that are not there.

The effects of hypnotic suggestion are not

limited to events that occur only during the hypnotic trance; the operator can make suggestions which will affect the person's behavior for long periods of time after the hypnotic session. Posthypnotic suggestions are usually effective, however, for only a few days.

In one recent study a subject was told while he was under hypnosis that a particular sequence of pages in a borrowed book would look blank to him whenever he looked at them. Upon awakening, the subject was not told about the posthypnotic suggestion, but when he returned the book two months later he volunteered the information that the book was defective, some of the pages being blank. He pointed out the "blank" pages and appeared astonished that no one else noticed this "defect" (Weitzenhoffer, 1950).

By posthypnotic suggestion, pain and symptoms growing out of organic as well as psychological disturbances can temporarily be suppressed. This type of hypnotic treatment is sometimes dangerous because it seems to make direct treatment unnecessary. Actually it removes the danger signal of pain without curing its cause.

Hypnotic regression. Hypnosis can also be used to establish *regression*. This often makes hypnosis valuable to the therapist in diagnosing the cause of emotional disorders. The hypnotized subject is told that he is at a younger age and is asked to tell what he has been doing, how he feels, what his ambitions are. Under hypnosis a subject will vividly recall and relive experiences that he has forgotten or repressed for years.

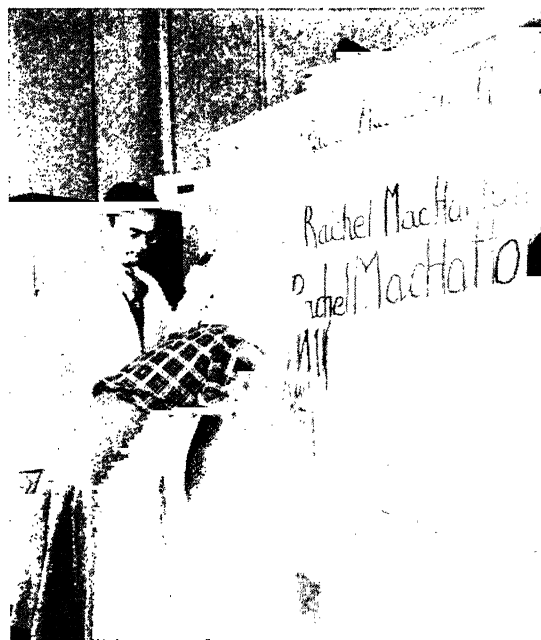
Psychologists have devoted considerable attention to the problem of whether hypnotic regression is real or whether the hypnotized subject merely responds as he thinks he should when the operator suggests that he has regressed to an earlier level of development. The available evidence, although not entirely conclusive, indicates that real regression probably can occur under hypnosis, providing the subject enters a sufficiently deep trance.

In one study, fifty subjects ranging in age from twenty to twenty-four were asked, before the trance was induced, to state the day of the week on which certain relatively recent events had taken place. The number of correct answers was so small that they could be attributed largely to chance. Under hypnosis, the subjects were then regressed

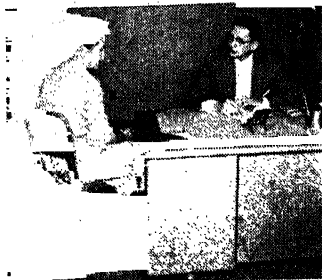
year by year and quizzed about memorable chronological landmarks as they went back in time. Under these conditions, over 90 per cent of the subjects were able to state the correct day of the week (as checked against a perpetual calendar) on which Christmas and their birthday fell when they were ten years old. The subjects were only slightly less accurate in stating the day of the week on which their fourth birthday fell (True, 1949).

This study would have been more convincing had the subjects been asked—first in a waking state and then under hypnosis—to recall childhood experiences that occurred at different age levels. Recall under the two conditions could then be more fully compared. Waking recall usually improves if the experimenter supplies the subject with memorable chronological landmarks and gives him ample time to remember.

Various studies in hypnotic regression have shown that when subjects are taken back to a particular age and asked to write their names,



At the University of Chicago, Drs. Theodore R. Sarbin and Julian H. Lewis have conducted extensive research on age regression under hypnosis. The handwriting on the blackboard represents different age levels of regression. At the top is the subject's normal handwriting, next her handwriting when hypnotized and told she was ten, then when she was told she was six. At earlier ages it became the unintelligible scribble of a pre-school child.



Integrated Therapy

These pictures taken at the Patton State Hospital in California show how a mentally ill woman, portrayed by a hospital employee, is gradually helped along the way to recovery.

Apprehensive and fearful, the patient arrives at the hospital. As soon as possible she is interviewed by a staff physician to determine her mental and physical condition and to schedule various laboratory and psychological tests, the results of which will help determine what treatment she should receive.

The physical examination includes laboratory tests, a chest X-ray, a complete dental survey, and special tests as needed. When necessary, treatment is given.

Psychological group testing is carried out to gain an understanding of the patient's problems and her typical patterns of adjustment. If she has special problems, she is also given individual tests.

Part of the patient's treatment is psychotherapy with a professional therapist. This helps her gain an

understanding of herself and of the meaning of her actions. Other treatment includes electro-shock (page 219) or perhaps a sodium amytal interview (page 219).

When she has improved, she is brought before a staff conference where discussion brings out her changes in thinking and behavior. After evaluating her progress, the staff decides she is well enough to go home.

Initial planning for her return began when she entered the hospital. A psychiatric social worker interviewed her—and her family—then to find out pertinent background material and to give consideration to any changes needed at home. Now the same social worker interviews both the patient and her husband to prepare for her return home.

But the end of her hospitalization is only the first step in recovery. On her return home the patient gets more assistance at the local Bureau of Social Work.

they use the same handwriting they actually used at that age (as shown by comparison with actual specimens of their earlier penmanship). Even this is not conclusive proof of regression, however, since it is possible that the subjects could remember their earlier handwriting and even imitate it consciously.

Clinical experience has demonstrated the value of hypnotic recall in recapturing repressed experiences and thus giving the clinician insight into the patient's problems. When the patient is in a waking state, the therapist can then guide him along lines suggested by the hypnotic revelations.

In the hands of the competently trained operator, hypnosis has therapeutic value; but it should be practiced only in the research laboratory and clinic, not in the home or dormitory, for there are certain precautions to be taken in hypnosis which the amateur cannot fully understand. Amateurs will have little difficulty in learning the technique of *inducing* the trance state, but they cannot be trusted to recognize and cope successfully with some of the possible *aftereffects*. For instance, there is always a danger that the patient will become dependent upon hypnotic treatment to remove some of his superficial symptoms and will not persist in solving his problem at the source. Another serious possibility is that the operator will suggest ideas to the patient which were not there before and thus seriously distort his unconscious emotional patterns.

INTEGRATED THERAPY

Developing rapidly, the field of psychotherapy still suffers from growing pains. Although many specific techniques of mental healing have been advanced, some based on elaborate theories and others merely on practical experience, none has proved universally effective. In the face of this situation, most therapists have adopted an *eclectic* approach, stressing no particular procedure but rather evaluating the contributions of each method and using from each whatever is appropriate to the needs of an individual patient. "The patient should not be limited to any method because it is the only one a particular psychiatrist uses. Each patient is entitled to a broad

application of medical and psychological knowledge" (Tietz and Grotjahn, 1951).

The eclectic philosophy leads to an *integrated* therapy in which various techniques are used in various combinations, depending on the individual case. Thus, in a particular patient's program of treatment, the therapist might use such techniques as free association, dream analysis, hypnosis, psychodrama, and any physical methods that might be indicated. Although most eclectic therapists tend to think broadly in psychoanalytic terms, they do not limit themselves to Freudian techniques.

PSYCHOBIOLOGY

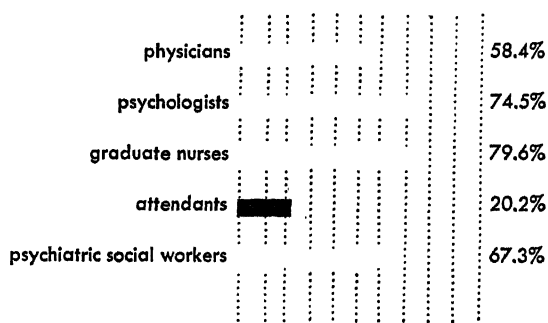
The ideal of the eclectic method was first advanced by Dr. Adolph Meyer, famed Johns Hopkins psychiatrist. Meyer's approach, which emphasizes the inseparability of the *psychological* and the *biological* processes in the whole organism, is known as *psychobiology*. The psychobiological approach aims at an understanding of all the factors—biological, psychological, and social—that are involved in a disorder.

Once the true nature of the emotion-provoking situation has been established—by whatever methods—the therapist's aim is to help the patient face the situation without extreme emotion, so that he can equip himself with a set of responses that will allow him to cope successfully with it. The processes of eliminating undesirable emotional reactions and acquiring new adjustment skills are referred to as *desensitization* and *redirection*.

INSTITUTIONAL CARE

The most complete program of integrated therapy is found in mental hospitals where the patient receives treatment on a teamwork basis, with psychiatrists, psychologists, occupational therapists, and other specially trained personnel all contributing their special therapeutic skills. The seriously disturbed patient can derive important benefits from living in an institution under close observation and protection. Under these conditions he is relieved of making difficult decisions; his life, to a certain extent, is "lived for him" without his having to face many of the frustrations of normal living. Guilt feelings tend to be reduced in the presence of others who are hav-

Per Cent of Necessary Personnel Lacking in State Mental Hospitals in 1955



National Health Education Committee, 1957

ing similar difficulties. Moreover, the patient is kept from endangering the safety—both physical and financial—of himself and those around him.

The patient in an institution has at his disposal various facilities besides purely medical treatment. *Occupational therapy*, for example, is employed in all good hospitals. This term refers simply to "healing through keeping busy." Engaging in such simple, rhythmic activities as knitting, weaving, sewing, or polishing metal or furniture quiets the overactive patient. The depressed patient may be helped by stimulating activities in which there is a minimum of routine or stereotyped behavior. Such activities as music, dramatics, creative art, and athletic contests—requiring close attention and rapid decisions—tend to keep the patient from thinking morbidly about himself and provide interesting and satisfying contacts with reality.

Life in a well-run institution follows as normal a pattern as the condition of each patient permits. Church services, motion pictures, and dances, which are attended by patients, doctors, and nurses, all contribute to the cure.

The institutional care and treatment of mentally ill individuals is a medical, financial, and social problem. About half of the hospital beds in the country are occupied by mental patients, and at least one out of every twenty persons will spend part of his life hospitalized for a mental disturbance. This does not mean that mental disorders are more prevalent than physical illnesses but that mental disease is generally more difficult to cure and therefore requires hospitalization for a longer period of time. Actually, only about

1 per cent of the population is incapacitated on any one day by mental disorders (Dublin, 1951).

State mental hospitals are operated by each of the forty-eight states, and in most states appropriations for the care and treatment of mental patients constitute one of the largest single items in the budget. Yet even in states conducting enthusiastic mental hygiene programs, facilities are inadequate. Almost all state hospitals are severely overcrowded. According to one estimate in 1956, mental hospitals have only about 56 per cent of the number of beds needed to give patients good care (National Association for Mental Health, 1956). The expense of new and expanded facilities to remedy this situation is, of course, tremendous. Furthermore, there are not enough trained psychiatrists, psychologists, and other capable personnel to staff new hospitals and utilize new equipment if they were provided. The seriousness of the situation is suggested by the chart at left, showing estimated shortages of psychiatric personnel in our state mental hospitals. In the final analysis, public opinion and social pressure will determine what is done, through legislation and otherwise, to improve the situation (Bane, 1951).

S U M M A R Y

The *mental health movement* was started in the United States by Clifford Beers shortly after 1900. Gaining considerable impetus in the past ten or fifteen years, it seeks (1) to create public awareness of the importance of psychological *prophylaxis* in the prevention of mental illness and (2) to gain recognition for *psychotherapy* as a method of treating personality and behavior disorders. Mental health workers have put special emphasis on such prophylactic measures as establishing healthy parent-child relationships; cultivating adjustive techniques for handling everyday problems; and supporting and utilizing community guidance facilities.

The fundamental goal of all psychotherapeutic methods is helping the individual improve his *modes of response* to real-life situations. The simplest method is *directive counseling*, in which the therapist supplies

direct answers to problems that are consciously worrying the client. In *client-centered* or *nondirective* therapy, on the other hand, the therapist encourages the patient to "talk out" his own problems. The therapist's role here is to lend an atmosphere of support and to help the client clarify his feelings by "reflecting" them back to him.

Psychoanalysis, developed by Freud, is a theory of personality as well as a thoroughgoing method of psychotherapy. It divides the personality structure into three parts: the *id*, which is the storehouse of instinctive pleasure-seeking impulses derived from the libido, or "sexual" drive; the *ego*, which controls the expression of these impulses in accordance with the demands of social reality; and the *superego*, which acts as the individual's "conscience," guarding his ideas of right and wrong. The ego must *compromise* the conflicting demands of id and superego. Neurotic symptoms, according to Freudian theory, are symbolic outlets for frustrated impulses of the id.

A basic tenet of psychoanalysis is that the individual is *unconsciously motivated* by *repressed conflicts*, many of them originating in childhood. To bring these conflicts to consciousness so that the patient can solve them, psychoanalysts employ the techniques of *free association*, *dream analysis*, *analysis of resistances*, and *analysis of transference*. Recent advocates of psychoanalysis, sometimes called *neo-Freudians*, have emphasized that *cultural factors* as well as childhood experiences and biological cravings can precipitate mental disturbances. They are less concerned with lifting childhood repressions than with understanding the patient's *present situation* and *directing* him toward more satisfactory adjustive responses.

All methods of psychotherapy share certain important characteristics. To a greater or less

extent, all employ the principle of *catharsis*. Successful therapy, regardless of the specific techniques used, is always conducted in a *permissive* atmosphere in which the patient can express himself freely; and the therapeutic relationship is such that the patient receives *understanding* and *support* while he is working out his problems.

Severely disturbed patients may require physical methods of treatment, such as *shock therapy*, *narcosis*, *chemotherapy*, and in extreme cases a lobotomy or some other form of *psychosurgery*. In the field of chemotherapy, promising results have recently been obtained with drugs that help relieve the patient's symptoms and make him more amenable to psychotherapy. Wherever possible, all physical methods of therapy should be combined with psychotherapy, which treats the *causes* as well as the *symptoms* of mental illness.

Special techniques of therapy include the *psychodrama*, in which the patient acts out experiences related to his emotional disturbance; *group therapy*, in which various individuals try to work out some common problem; *play therapy*, in which the individual is allowed to "work off" his pent-up emotions; and *hypnosis*, used both to relieve neurotic symptoms and to gain insight into the causes of disturbance.

Often the therapist uses an eclectic approach, adapting various methods to the needs of the individual patient in order to provide an *integrated therapy*. One integrated approach, known as *psychobiology*, emphasizes the interrelatedness of biological, psychological, and social factors in the origin and treatment of emotional disturbances. Good *institutional care* offers the most complete program of integrated therapy for those who are seriously ill. There is a pressing need today for increased facilities of this type.

PART THREE

OVERVIEW

KNOWING

THE WORLD

While you are developing your own unique pattern of personality traits, using or failing to use your abilities, responding to your inner drives, expressing or curbing your emotions, and dealing with frustrations and conflicts, you are at the same time constantly learning about yourself and the world around you. Indeed, learning plays a large part in determining the course of your development, the nature of your motivations, and the ways you handle your emotional problems, even while they, in turn, are influencing what you learn. This interdependence of the various psychological processes is one of the reasons why it is so hard to gain an understanding of human behavior. You cannot study one facet and then set it aside while you study another, because each is constantly affecting and interacting with the others.

Thus, as we focus our attention in this group of chapters on the processes by which we come to know about our world, we must keep in mind what we have learned in the earlier chapters about development, abilities, measurement, and motivational forces—much as a juggler keeps several plates spinning while he starts new ones going.

Learning begins with sensory experience. Without perception, learning and indeed behavior of almost any kind would be impossible. Since the sense organs are the portals through which information comes to us, we shall devote a whole chapter to the traditional five senses, plus a few others you may not realize you possess. Then in Chapter 10 we shall see that the sense organs and the stimulus pattern only partly explain what we perceive; past experiences, present needs, and a number of other factors also play a part. This explains why people often have different perceptions in the same objective situation and why even the same person perceives differently at different times.

Following the discussion of perception are two chapters on learning which are especially important to you as a student. Chapter 11 describes different kinds of learning, the ways learning is measured, and the two main general theories of how learning takes place. Chapter 12 reviews what research has discovered about how people can make learning more efficient. You will find that your level of ability is only partly responsible for how well you learn. There are many other factors, largely within your control, which you can put to work for you to make your learning and remembering more efficient.

Your knowledge and understanding go far beyond your perceptions and what you remember from them. As you perceive and learn, you are constantly evaluating, judging, and actively "putting two and two together." When you encounter a new problem, you start trying to figure out a new solution, creating and using symbols to range far beyond the limits of the materials your senses provide. So in the final chapter of this group we shall study this process of thinking and the creativity that gives man his greatest advantage over the lower animals.

CHAPTER NINE

THE SPECIAL SENSES



CONDITIONS OF SENSATION

VISION

HEARING

OUR CUTANEOUS SENSES

OUR SENSE OF ACTIVE MOVEMENT

OUR SENSE OF PASSIVE MOVEMENT

OLFACTION

OUR SENSE OF TASTE

In the routine of daily life we are so busy using our intricate and efficient sense organs that we seldom pause to think about how they operate, how very sensitive they are, or even how much our daily adjustments depend upon them. Ordinarily we do not make full use of our senses. Our eyes, for example, can detect a match flame twenty miles away under ideal atmospheric conditions. Or they can perceive a thin wire whose diameter is equal to 1/500,000 of the total field of vision. Theoretically this is equivalent to seeing a telephone pole (one and a half feet in diameter) at a distance of approximately forty-five miles! What complex mechanism makes such keenness of sight possible? And what delicately tuned apparatus in our ears enables us to hear the low rumble that gives a sensation almost like that of touch or the high screech that is almost like pain?

Although five senses have been traditionally recognized, psychologists now know that there are others. Just how many no one yet has determined. In Chapter 5 we have already discussed the organic senses (senses of internal bodily condition) because of their relation to biological drives. In this chapter we will cover the following kinds of sensory processes: *visual* (sense of sight); *auditory* (sense of sound); *cutaneous* (senses of pressure, pain, warmth, and cold); *kinesthetic* (sense of active movement); *labyrinthine* (sense of passive movement); *olfactory* (sense of smell); and *gustatory* (sense of taste).

CONDITIONS

OF SENSATION

Our many senses, each so remarkable in itself, act cooperatively. Any complex object becomes known to us through the combined action of several senses. An outstanding team is that of taste and smell. As you may have discovered when a bad cold temporarily dulled your sense of smell, most flavors, which we think we taste, are largely aromas. Actually, to enjoy a good meal we need many other senses besides smell and taste—sight, touch, warmth or cold, and perhaps even the mild pain caused by certain spices and condiments.

Four essential conditions or actions are involved in a sensory response:

1. A *stimulus* is supplied, internally or externally. A stimulus is some form of radiant, chemical, or other energy that activates a receptor or, more often, a large group of them. Energy strong enough to produce a response is said to be above the *limen* (absolute threshold); energy too weak to produce a conscious response is *subliminal* (below the absolute threshold).

2. The stimulus stirs certain *receptor cells* into activity. Usually a receptor cell is activated only by stimuli to which it is especially sensitive—a visual receptor by light waves, a taste receptor by chemical substances, and so forth. Sometimes a receptor can be stimulated by other kinds of energy, but even then it responds in its own characteristic manner. If you apply pressure to your eyeball, for example, you will experience a visual sensation. Similarly, a blow on the ear will produce “ringing,” an auditory sensation.

3. Nerve impulses travel from the receptor cells through the nervous system, the main *connecting mechanism*.

4. These nerve impulses may finally arouse activity in the *effectors* (muscles or glands) and/or produce conscious sensations.

Each of these four conditions is necessary for a sensory response. If any step were missing, we could not adjust to the world around us. Without Step 2 or 3 there could never be a Step 4, regardless of the adequacy of the stimulus.

We have already referred to the absolute threshold of the various senses—the minimum energy to which a particular sense can respond. This absolute threshold varies somewhat with each individual. Sensory sensitivity is also measured by the *difference threshold*—that is, the smallest difference in stimulus intensity that a particular sense can detect. For example, if a single fifty-watt lamp is burning in a room and someone turns on another of the same wattage, we immediately notice a considerable difference in illumination. But if someone turns on a fifty-watt lamp in a brightly lighted ballroom, we will not perceive any change in illumination. Whether our senses can discriminate a change in stimulus intensity depends upon the ratio of the added intensity to the intensity of the previous stimulation. This is known as *Weber's law*. The exact ratio varies with the kind of sensitivity being measured and with the range of intensities involved.

Another important characteristic of sensation is the phenomenon of *adaptation*, or the adjustment of the senses to a particular stimulus. After being in a darkened room for a short time, we gradually can see more clearly. Most odors soon “disappear” if we stay in their presence. We are usually unaware of the pressure exerted by our clothing or a wrist watch. These are all examples of sensory adaptation; later in this chapter we shall have occasion to discuss many others. All our senses are subject to the effects of adaptation, though some adapt more readily than others.

We do not always respond to sensory stimuli even when they are adequate. Much incoming nervous activity is “lost” or inhibited within the central nervous system. When you are concentrating on what someone is saying, for example, you probably are unaware of the movement of other people around you or of a change in room temperature and make no response to them. Under certain circumstances, however, you may respond to stimuli without being aware of them at all. When you are asleep, the sound waves in your environment will cause your eardrums to move and nerve impulses will go to the central nervous system, but you will not have the sensation of “hearing”—though an unusual noise may make you twist and turn.

Having examined the general conditions of sensation, let us turn our attention now to one

of the most useful—and most thoroughly studied—of all our senses, the sense of sight.

VISION

The sense of sight, so important to survival, has followed a fascinating course of development. The intricate human eye apparently has evolved from a few light-sensitive cells such as those found in primitive forms of life. Gradually, as more advanced forms developed, there appeared a greater number of visual elements per unit area, an especially sensitive central spot, and more complex nerve pathways and brain areas which made possible a more intelligent appreciation of visual patterns (Detwiler, 1956). In some forms, the eyes also swung gradually around to the front of the head so that binocular vision became possible. As we shall see in the next chapter, it is very important that man can see his physical environment from two slightly different points.

In the course of evolution, some species acquired very queer-looking eyes indeed. But despite their appearance, the eyes of all other vertebrates have much in common with the human eye. All have three layers: an outer protective coat called the *sclera*, a portion of which—the cornea—is transparent; a middle layer rich in blood vessels called the *choroid coat*; and a sensitive inner layer called the *retina*. In the sensation of vision, light must travel through the nerve layers of the retina before reaching the receptor cells. No explanation has yet been found for this apparent defect in Nature's plan.

The eyes of all vertebrates operate through similar mechanisms, to be described below. Although man's superior brain connections enable him to make more intelligent use of his eyes, the human eye is inferior to that of reptiles and birds in some respects. The visual acuity of some hawks and eagles, for example, is eight times that of the human eye.

HOW OUR EYES WORK

In studying the human eye, the psychologist is interested primarily in *visual acuity* (sharpness of vision) and *color discrimination*. To understand these complex processes,

he must venture into many fields—optics, physiology, and even physics.

Anatomy of the eye. Camera fans will be quick to see a strong resemblance between the eye and the camera. As shown in the diagram below, both have an adjustable opening to regulate the amount of light coming in, a lens for focusing, and a sensitive surface to receive the image. The eye, however, is far more sensitive to light than is photographic film. In fact, physiologists have calculated that the human eye has reached the absolute threshold of sensitivity to light. Under certain conditions, it responds to one *quantum* of light energy—the smallest imaginable amount.

The diagram on page 238 describes the parts of the eye and how they operate. In order for us to “see” something in the outer world, a pattern of light from the object must pass first through the *cornea* (a protective covering) and then through the *pupil*. The pupil is an opening in the *iris* which adjusts in size to regulate the amount of light entering the eye. This influences the brightness and the clarity of the image. The light rays that make up the image penetrate the *lens* (an oval structure), which focuses the light rays onto the sensitive surface of the *retina*. This sets

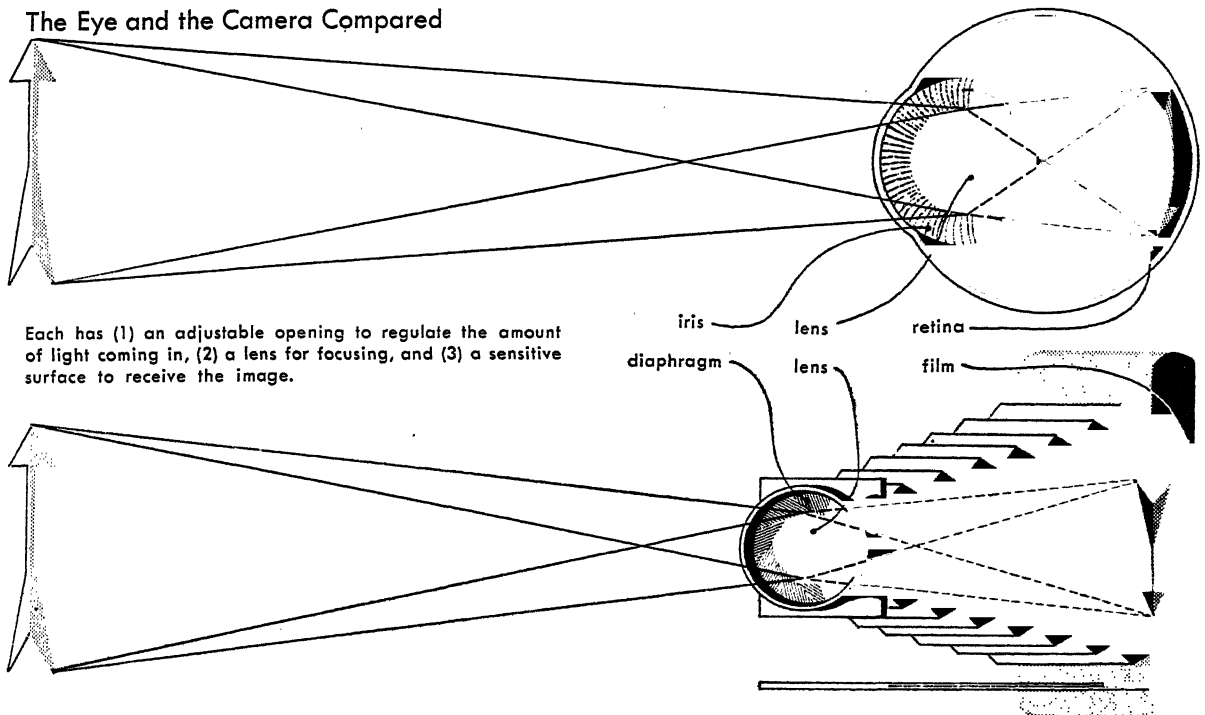
up chemical reactions in the retinal receptors, initiating nerve impulses which then travel to the *optic nerve* and finally to the *occipital* area at the back of the brain. (These connections are explained further in the Reference Manual, page 492.) Every point in space reflects light to visual receptors in the retina, creating a pattern of stimulation that is carried by nerve fibers to the brain, where a corresponding pattern of cells is activated.

We all know that a sensation becomes stronger as the stimulus becomes stronger—this is because more nerve cells are caused to respond *more frequently*, not because each one responds more violently. A cell either reacts with full intensity or does not react at all.

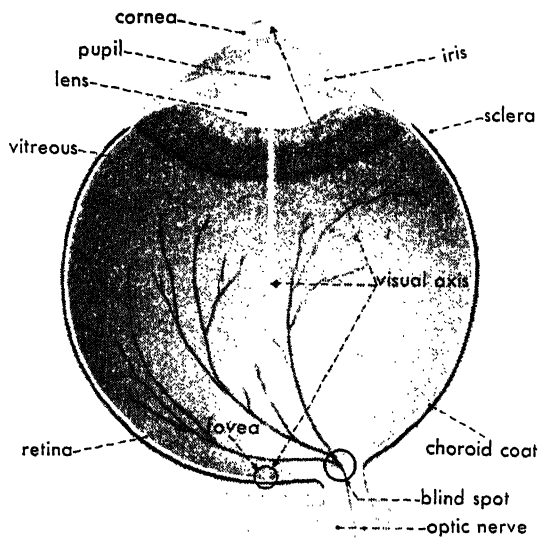
Seeing by day and by night. There are two kinds of receptor cells in the retina, called *cones* and *rods* because of their shapes. The cones make sensations of hue and brightness possible and are effective only when the eye is adapted to light. The rods, on the other hand, are capable of producing sensations of white, gray, and black—that is, of brightness but not of hue. They are effective in both day and night vision.

There are more than seven million *cones* in the human retina. They are packed most closely together in the very center of the

The Eye and the Camera Compared



Cross section of the left eye



retina, an area known as the *fovea*. Images are clearest when light from objects stimulates this region. There are no rods at all in the fovea. The reason that an object can be seen most clearly by daylight, when the cones operate, is that we can then use the fovea. When there is little light, however, we must depend on our rods to see. This means that we can see an object only if we focus on it in such a way that the image does not fall on the fovea—thus the image is less sharp.

Dark adaptation. All eyes—including a cat's—are alike in that none of them can see in complete darkness. But the human eye can adjust remarkably well to changes in the strength of lighting. If you hold a piece of white paper in direct sunlight, you can still see printing on it, although such strong reading light is uncomfortable for all eyes and even injurious to some. At the other end of the scale, people are capable of seeing under illumination only a seven billionth as strong as ordinary daylight, provided the eyes are properly prepared. You undoubtedly have had the experience of going into a darkened theater and being unable to find your way to an empty seat without help. Yet when you got up to leave at the end of the picture, you could see quite well. The process which prepares the eyes to see under low illumination is known as *dark adaptation*. For most people

after the last use of the eyes in bright light.

Discrimination between hues becomes less keen as the level of illumination falls. In the dark-adapted eye, hue discrimination disappears completely, for the color-sensitive cones cease to function and the “color-blind” rods take over the job of seeing. This change-over from the cones to the rods occurs when the level of illumination falls to about the degree of illumination provided by a full moon.

As the eye becomes adapted to dark, sensitivity is lost first to red and yellow and then to blue and green. This is known as the *Purkinje effect* and explains why the hues at the violet or short-wave end of the spectrum seem to become bright at nightfall, whereas in the daylight they seem darker. During World War II air-raid wardens used blue flashlights—an extremely ill-advised practice, because under blackout conditions blue is seen better than any other hue by the dark-adapted eyes of observers. A similar error was made by the Navy in providing blue lighting on ships. The error was soon discovered and red lighting was substituted.

Another advantage of red light is that it permits the cones to see while the rods are becoming dark-adapted. This fact is exploited in situations where military or professional personnel must shift from bright to blacked-out areas of work without having time to let their eyes become adapted to the lack of light. Before going on night lookout duty, for example, a sailor either wears his red goggles or stays in compartments illuminated by red light. Complete dark adaptation cannot be achieved even under these conditions, however, for the rods are not *totally* insensitive to red light (Griffin, Hubbard, and Wald, 1947).

You can perform a simple but interesting experiment on dark adaptation by staying in a dark room for half an hour. At the end of this period turn on the light for a few seconds, first closing one eye and holding your hand over it. Then turn off the lights again and open both eyes. Observe the room first through the eye that has been closed all the time and you will be able to see objects fairly clearly. Then close that eye and observe the room through the eye that was exposed to the flash of light; the room will appear totally black. This simple experiment demonstrates that the process of dark adaptation takes place in the retina of each eye rather than in the brain. The Army has taken advantage of

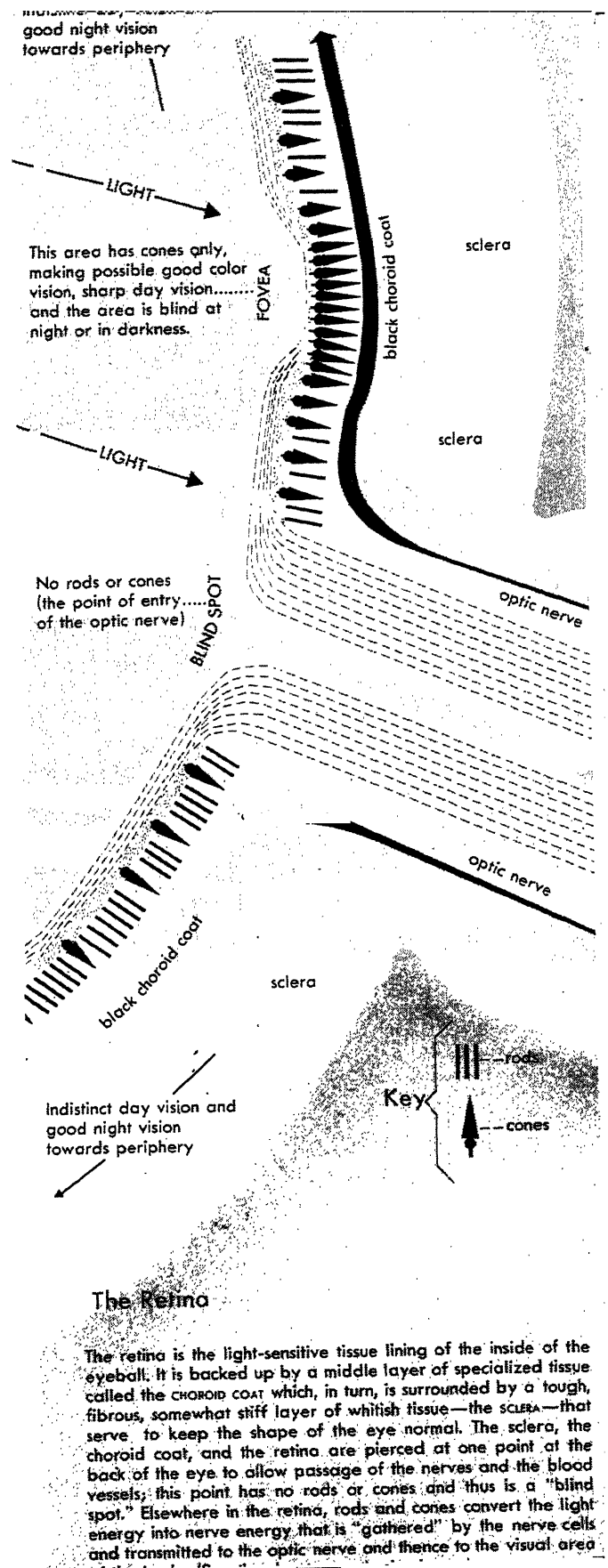
night missions by teaching the men to keep their sighting eye closed when setting off a flare or otherwise using light. The aiming eye thus retains its dark-adapted condition, making accurate marksmanship possible.

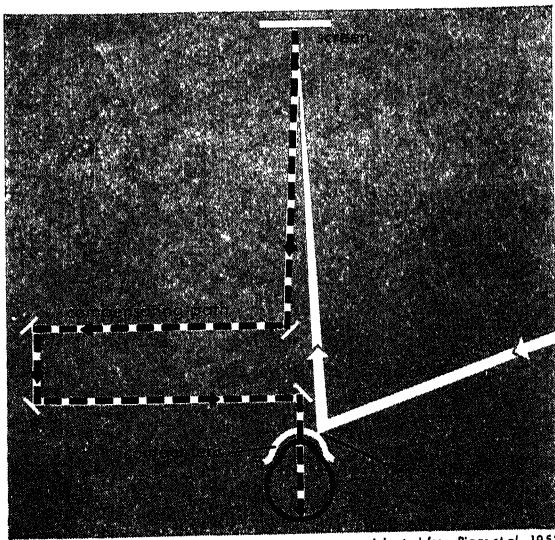
There is an opposite phenomenon of *brightness adaptation*. We have all experienced the painful glare of light when coming from a movie theater into the sunshine outside. After a few minutes adaptation to the light is complete. Light adaptation is simply the absence of dark adaptation, which is lost much more rapidly than it is acquired.

Eye movements in focusing. Our eyes are moving constantly—voluntarily and involuntarily—through the use of a complex oculomotor mechanism. When we look at an object, changes in position and dimension of various parts of the eye take place. (1) When focusing upon objects within about twenty feet, the eyes turn toward each other so that both eyes may fixate the same point in space. This is called *convergence*. (2) The lens increases in thickness to focus on near objects, flattens for distant vision. This is called *accommodation*. (3) An independent rotation of each eye about its axis adjusts light from an object so that it strikes corresponding parts on the two retinas. This delicate adjustment, *cyclofusional movement*, sharpens the retinal image. (4) The iris adjusts the size of the pupil so that an optimal amount of light strikes the retina. A contracted pupil produces a sharper retinal image, besides preventing an excessive amount of light from damaging the retina. (5) The eyes themselves are in almost constant motion in order to point toward and follow the objects we wish to see. In so doing, they make movements of two kinds: *jump* and *pursuit* movements.

Photographic records of eye movements show that when the eye is looking at anything motionless, it does not glide smoothly but makes a series of jumps—it jumps, then stops, then jumps again. Thus the eyes stop several times in reading a printed line. Exploration of distance by an eye movement is nearly equivalent to pacing the distance with measured strides. Just as we can tell the length of a room by pacing it off, so we can tell the distance between any two *fixed* points by “pacing it off” with the eye.

But in following *moving* objects the eye glides in pursuit movements. One general rule of clear vision operates both in reading and in following moving objects—the eye sees best





Adapted from Riggs et al., 1953

when the image falls on the center of the fovea. The eyes must move in unison with a moving object to retain this condition, and that is why they are said to be in "pursuit" of the object.

Movements of the eyes are easier in the horizontal plane than in the vertical. This is fortunate, since we more often have to judge the movements of objects coming from the side than from above.

An interesting indication of the greater ease of side-to-side as compared with up-and-down eye movements is seen in the results of tests on young babies. One psychologist determined the average age at which external objects first aroused pursuit movements of the eyes. Side-to-side movements appeared at fifty-eight days, up-and-down movements at sixty-five days, and round-and-round at seventy-eight days. It is quite clear that the side-to-side movements are more "natural" in the sense that they are perfected earlier in life (Jones, 1927).

It is impossible to keep our eyes from moving, no matter how hard we may try to stare fixedly at an object; but scientists have designed a complex apparatus by which they can keep up with the eye's constant movements and force it to use the same rods and cones to perceive an object over an indefinite period of time.

In these experiments the subject wore a special contact lens with a tiny mirror attached to it. An image of the test object was projected to this mirror,

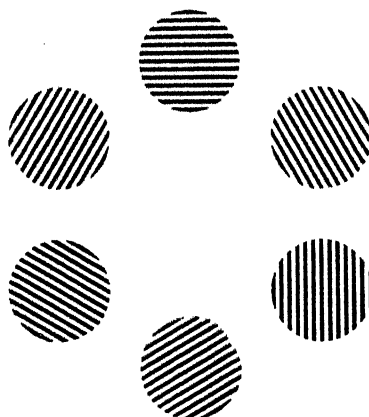
which in turn reflected it to a screen in front of the eye (see illustration at left). The subject viewed the image on the screen through a compensating system of prisms which served to maintain the correct apparent distance between the image of the test item and the viewer. The total effect of this complex apparatus was to make the image of the test object always fall upon the same receptor cells, thus "canceling out" the involuntary movements of the eye. The test objects used were fine wires of various diameters, each mounted in a rigid steel slide. They were shown one at a time and appeared on the screen as black lines.

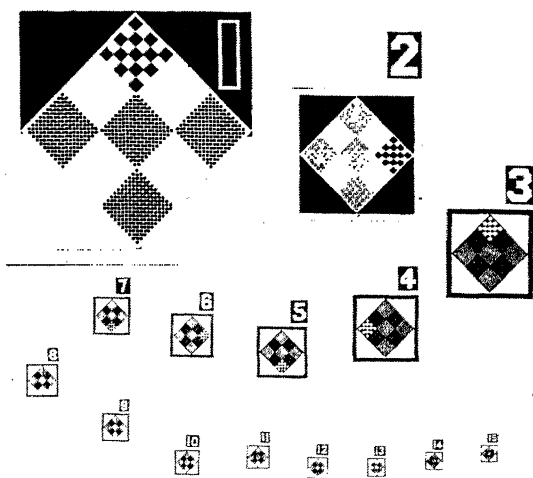
When subjects viewed each line for a full minute through the compensating prisms, the lines soon faded. The heavier ones tended to reappear from time to time during the minute interval, but the fine lines were "lost" permanently. When the same slides were projected under normal viewing conditions—that is, when the subjects' normal eye movements were not compensated for by the special apparatus—the heavier lines did not fade at all; the fine lines faded but reappeared. When the apparatus was used again but adjusted differently so as to double the normal extent of eye movements, not even the fine lines faded; in fact, the lines seemed to be "locked in place" on the screen.

It was also discovered that when the lines were projected for very short intervals, subjects could see finer lines when their eye movements were artificially "canceled out" by the apparatus than under normal viewing conditions (Riggs et al., 1953).

These experiments show that eye movements interfere with visual acuity to some extent but that they more than make up for this loss by shifting the visual image from one

The Jensen Test of Visual Acuity





At left is a sample slide used in measuring visual acuity with the Ortho-Rater. The boy at right is being tested with the School Vision Tester, which uses "Tumbling E" slides instead of checkerboard ones. The subject must tell the tester whether the prongs of the E go up, down, to the right, or to the left. This apparatus is used by schools to quickly identify children whose eyes need further attention.

group of receptor cells to another so that it does not fade out.

VISUAL ACUITY

Visual acuity means literally "sharpness of vision." It can be measured in terms of (1) the smallest object that can be seen at a standard distance or (2) the greatest distance at which a standard-sized object can be seen.

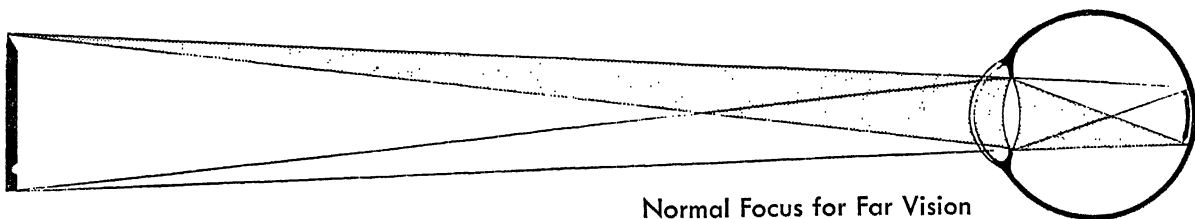
Measuring visual acuity. You have undoubtedly heard it said of some keen-sighted individual, "He has perfect vision—20/20 in both eyes." Such a person might be described more accurately as having "standard" vision, because the numbers 20/20 simply indicate that a person is able to see a standard-sized object from a standard number of feet away. This method of measuring visual acuity developed from the use of the familiar chart of test letters, placed twenty feet from the subject being tested. Even if you have never had your eyes examined for glasses, you doubtless have been tested with such a block-letter chart in the course of routine physical examinations. After testing millions of eyes, oculists established a certain size of block letter as that which a *normal eye* can read at twenty feet. Eyes which can read these letters at that distance are described as "20/20." Persons who can read the standard-sized letters

at *twice* the normal distance are said to have 20/10 vision. Different number systems are sometimes used, but in order to interpret any of them, simply determine the value of the fraction. Roughly speaking, a fraction with the value of $1/2$ means half normal visual acuity, while one with the value of 2 means twice normal.

Although widely used, the block-letter charts are unsatisfactory in many respects. For one thing, if a person wants to cheat he may be able to memorize the letters ahead of time. Furthermore, the letters of the alphabet lend themselves to guessing and differ in legibility. And, of course, the chart is useless for an illiterate person.

To avoid these difficulties, many other measures of visual acuity have been devised. In the Jensen Grid test, shown on page 240, grids of different angles are presented at standard distances, and the subject is asked in each instance to tell whether the lines point up, down, right, left, or at an angle. By systematic exploration the tester determines the distance at which the person can see the direction of the lines, and then expresses it as a ratio to the "normal" distance.

The armed forces have conducted extensive research on the measurement of visual acuity and have obtained good results with two visual screening devices, the Ortho-Rater and the Sight Screener (Sulzman, Cook, and



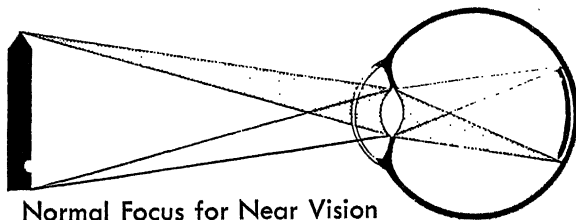
Normal Focus for Far Vision

Bartlett, 1946). When the Ortho-Rater is used, the subject views slides like the one shown on page 241 and is asked to identify the location of a black and white "checkerboard" in any one of four positions. Smaller and smaller checkerboards are presented until two successive targets are missed. Tests of this kind are convenient for use with large groups when individual tests by oculists are not feasible.

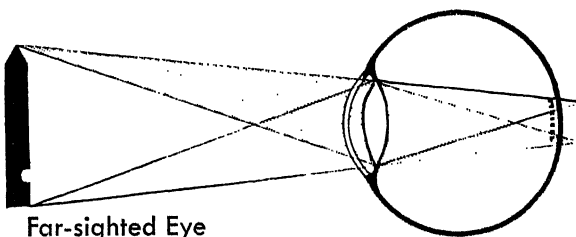
It is possible to test the visual acuity of infants by applying the fact that in darkness a baby will look toward a sudden light, provided it is not glaring (Schwartz, 1954). The apparatus used is a box, decorated with gay clown designs and containing a light bulb. In the front of the box is a frosted glass window across which steel wires of various diameters are moved. Regular movement is assured by fastening the wire to the arm of a metronome. The smallest wire which the eyes can follow provides the index to the child's visual acuity. This device was perfected through numerous tests on adults and now gives results so consistent with those of the widely used Snellen test (block-letter charts) that a given adult's performance on the Snellen test can be predicted from his performance on the steel-wire instrument. As determined by this device, normal infant vision is 20/400 at six months, 20/200 at one year, and about 20/50 at three years.

The neural basis of visual acuity. Visual acuity, as we have seen, is greatest in the fovea—the central part of the retina—where the cones are packed most tightly together. It is best, too, under good light, which is capable of stimulating the least sensitive cones as well as the most sensitive.

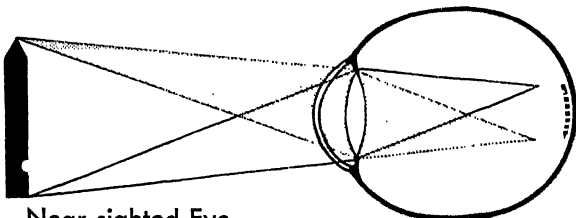
The size and shape of an object in the external world determines the size and shape of the pattern of receptors stimulated on the retina. If we are to "see" a line, at least two separate receptors must be stimulated. Since the cones are an average of about .0001 inch apart, we might therefore think that the image of an object would have to be at least .0001 inch long in order to be visible. How-



Normal Focus for Near Vision



Far-sighted Eye



Near-sighted Eye

ever, in certain circumstances the normal eye can see objects that produce images only one eighth as great as .0001 inch in one dimension, provided they are great enough in the other dimension. In order to understand how our accuracy of observation can apparently surpass the physical limits of our eyes and how we can see three-dimensional objects by means of a two-dimensional retinal surface, we will have to study the factors influencing *perception*. We will consider these in the next chapter.

The eye cannot distinguish two dots as separate points unless the retinal areas stimulated by light from the dots are separated by one functional unit which is *not* stimulated. The size of this unit varies in different parts of the retina. In the fovea it is but a single cell, for separate nerve connections exist between each foveal cell and the central nervous system. These cells, in other words, are on a one-

party line. But toward the outer edge, or *periphery*, of the retina, more and more of the retinal cells are linked together with the same nerve connection; some of them, we might say, are on a two-hundred-party rather than a one-party line. In the periphery of the retina, therefore, one functional unit consists of all the retinal cells which are linked to one connecting nerve. There is no mechanism, as there is with the cells in the fovea, for telling which particular cell has instigated a nerve impulse. In order for our two dots to be distinguished as separate points when their images fall on the *periphery* of the retina, therefore, they must be separated by a much greater distance—that is, the two points of stimulation must be as far apart as a whole *group* of cells. This is the main reason why we cannot see fine details out of the side of our eyes.

Common visual defects. Although vision will be impaired by defective functioning of *any* of the mechanisms of the eye, a faulty optical mechanism is responsible for many of the most common visual defects. The vast majority of people who wear glasses do so because the lenses of their eyes are inadequate in some way.

The lenses may bulge out too far, causing the image to come into focus slightly in *front* of the surface of the retina, so that it is seen as fuzzy. A person with such lenses suffers from near-sightedness, or *myopia*, and must hold paper work close to his eyes to improve his focus.

On the other hand, the lens may be unable to bulge out for close vision, either because it is inflexible or because the muscles controlling its shape are too weak. In such cases the image comes into focus *behind* the retina. This condition is known as far-sightedness, or *hyperopia*. Although distant objects may be seen distinctly, nearby objects are blurred.

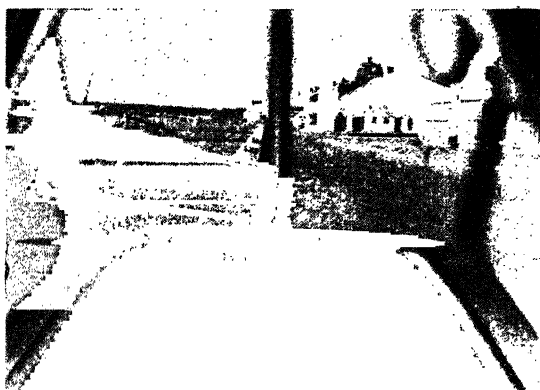
Fortunately, both of these visual defects can be corrected readily by glasses. So can old-sightedness, or *presbyopia*, a special condition of far-sightedness brought on by a hardening of the lens which occurs with age. Even near-sighted people may develop this condition. As you get older and your lenses lose their elasticity, the nearest point at which you can focus becomes farther and farther away, as shown in the table at right. Notice the rapid change beginning around the fortieth year—the “golden age” for oculists, optometrists, and lens manufacturers!



Normal

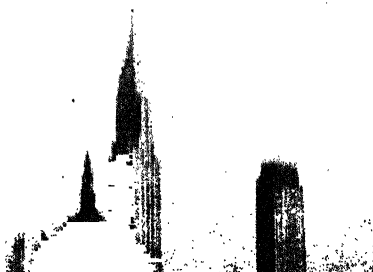


Near-sighted



Far-sighted

Age of Reader	Distance of Blur Point from Eyes
10	under 3 inches
20	under 4
30	under 5.5
40	under 8.5
50	under 15.25
60	under 39 or more



Astigmatism



Double Vision



Tunnel Vision

Hold this book in front of your eyes and move it closer and closer while a friend measures its distance from your eyes. When you have determined the blur point beyond which the printing becomes illegible, read the distance in inches and check against the table (Boring, 1945). This table is based on averages of people who are neither far-sighted nor near-sighted; individual deviations will occur.

Astigmatism, another common visual defect, may be caused by the left-right curve of the cornea being sharper (or flatter) than the up-down curve. This produces clear vision in one dimension but unfocused vision in the other.

Double vision, or *diplopia*, is caused by a muscular imbalance which permits light reflected from one point to fall on noncorresponding receptors in the two retinas, so that two slightly different images are transmitted to the brain. This defect can be caused not only by an inherent weakness of the involved muscles but also by disease, by various poisons, or temporarily by alcohol (Brecher, Hartman, and Leonard, 1955).

Tunnel vision is a concentric narrowing of the field of vision. The individual so afflicted sees things as through a tunnel or a pipe and is forced to make abnormally large movements of the head and eye in order to bring different parts of the environment within his field of vision. It can be produced also by a complex of factors.

Certain conditions, such as excessive use of tobacco or alcohol and overexposure to light, produce a temporary or permanent blind spot, *scotoma*, which seriously interferes with vision. Scotoma also accompanies some diseases, including migraine. It may develop when the retina is injured or diseased; or it may originate in the optical tract or in the brain.

Every person has a natural blind spot in each eye at the point where the optic nerve

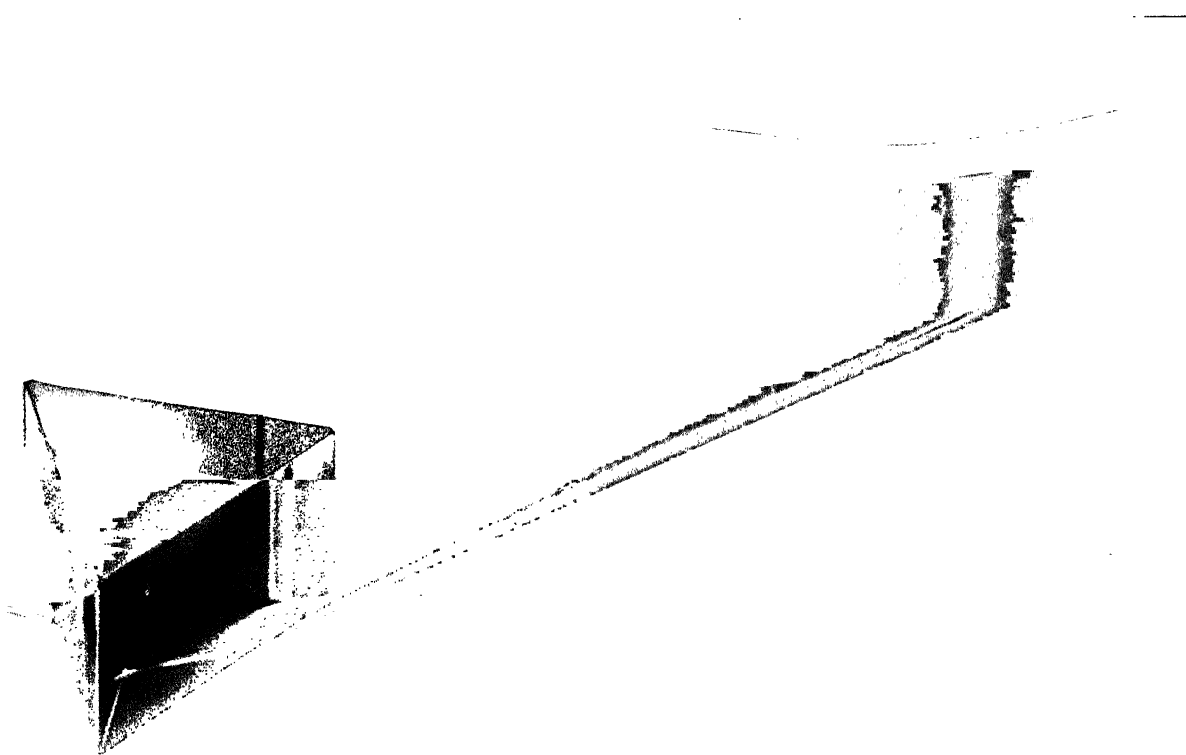
enters the retina. These are *not* regarded as scotoma. Usually we are not even aware of them—partly because they have always been there and partly because, when we are using both eyes, an image usually will not fall on both blind spots at once, since each faces a different part of our visual field.

COLOR VISION

Most people can distinguish between many more colors than they can name. Indeed, it has been estimated that a person of average vision can distinguish 350,000 colors from one another—whereas the trained human eye can discriminate 10,000,000 separate surface colors! These distinctions, of course, include other dimensions of color besides hue (Judd and Kelly, 1939).

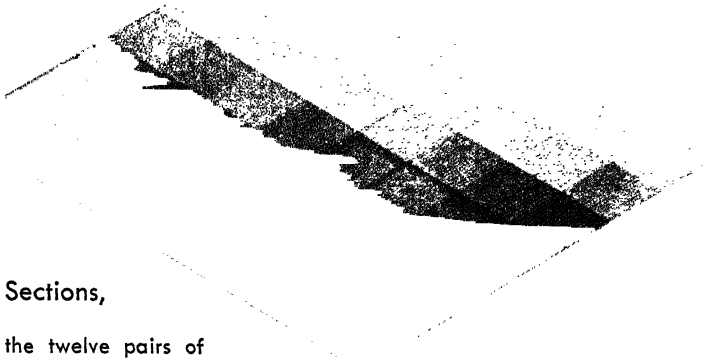
Several lines of evidence point to the *cones* as the necessary instruments of color vision: (1) Although rods respond to light, the light is almost always seen as lacking in hue. Rods alone cannot distinguish between hues. (2) Colors are perceived *only* when the intensity of illumination is high enough to bring the cones into action. In dim lights, as we have seen, the cones do not function. (3) The way the cones and rods are distributed on the retina is closely related to the ability of these different parts of the retina to distinguish hue. Color is perceived best when the central portions of the retina (containing only cones) are being stimulated. In the intermediate region of the retina, rods and cones are found together; here the retina is capable of distinguishing hues (cone function) and also of seeing when the light is dim (rod function).

Theories of color vision. Although a number of theories have been advanced to explain how the cones enable us to see color, none of them can account for all the phenomena of



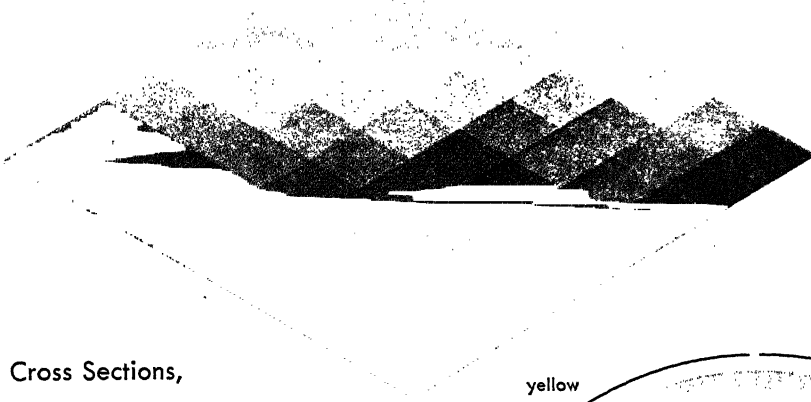
A prism can do what our eyes cannot—it can break down a beam of white light into its component colors, as shown in the photograph above. The colors to which we have sensitivity then form what we call "the visible spectrum," ranging from red at one end through the various hues to violet at the other end. Beyond this visible spectrum are ultraviolet and infrared, for which our eyes have no receptors. When an object reflects all colors equally, we see it as white; when an object absorbs certain colors and reflects others, we see only the reflected hues; when an object absorbs all the colors we see it as black.

The Color Solid, As Described in the Ostwald System



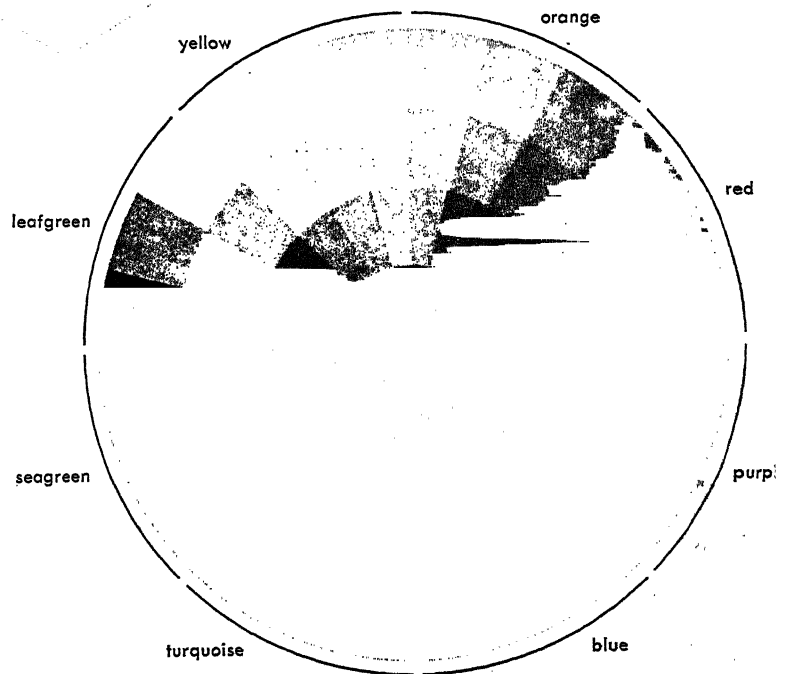
Vertical Cross Sections,

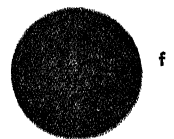
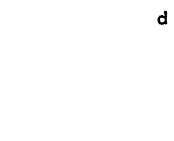
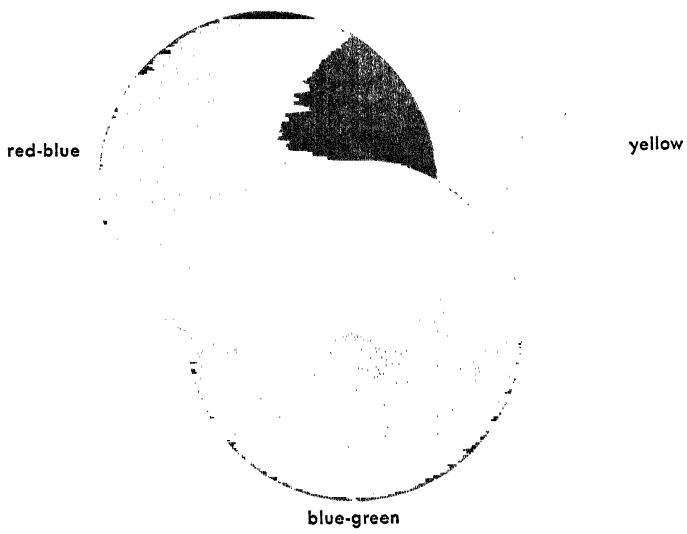
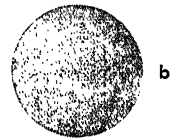
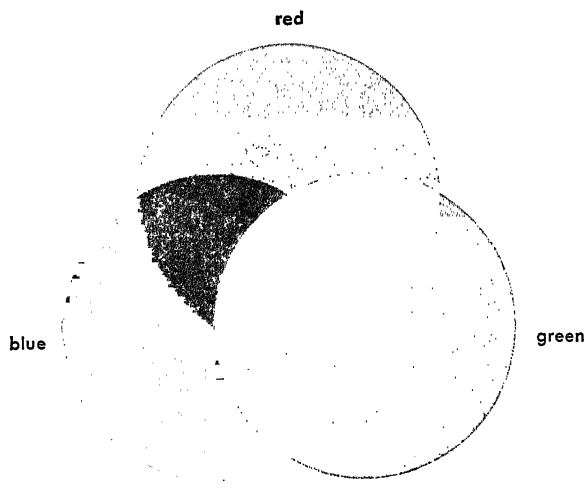
showing two of the twelve pairs of complementary colors appearing in the cone. In each large, diamond-shaped section can be seen the gray scale which forms the cone's vertical axis.



Horizontal Cross Sections,

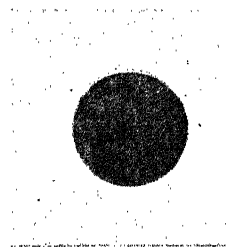
or "color wheel," taken at the widest point of the cone. This section shows the full range of twenty-four colors and their decreasing saturation as they near the center of the cone.





Light mixture is additive mixture. When we add together the three primaries of light—red, blue, and green—we get white. When we add any two of them, we get the complementary of the third. Red and green lights, for example, when mixed in equal proportions, yield yellow. Complementary colors, mixed by spinning colored disks on a wheel, will yield gray, a desaturated white. Yellow and blue (a), for example, give gray (b). This is an additive mixing process because our eyes receive a mixture of blue and yellow light reflected from the surface of the spinning disk.

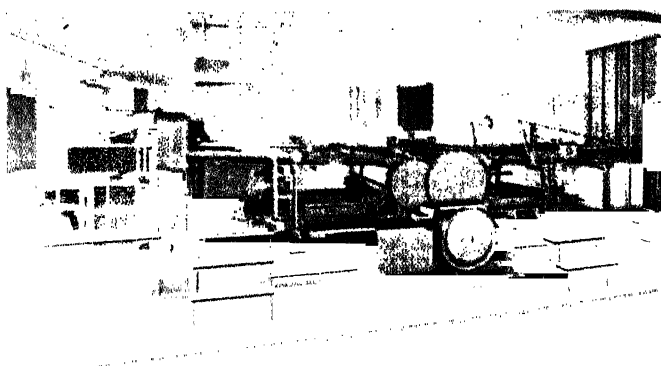
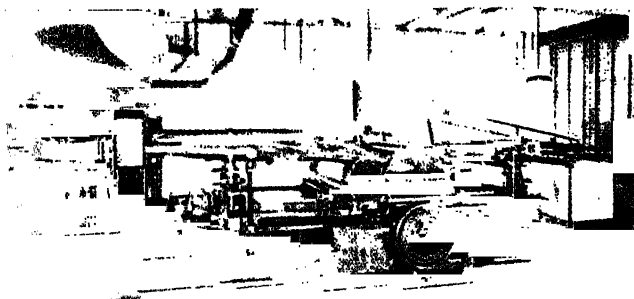
Subtractive color mixture can be illustrated by overlapping three filters—yellow, red-blue, and blue-green. The yellow filter transmits yellow, which is a combination of red and green. Blue, however, is not transmitted by the yellow filter: it is *subtracted*. Therefore, the light that comes through the yellow filter is white-minus-blue. In the same way the red-blue filter transmits red and blue light but subtracts green; the blue-green filter transmits blue and green but subtracts red. Thus when all three filters overlap, all the primaries are subtracted and we get black. Pigment mixture is subtractive mixture, because pigments absorb all hues but those reflected. When we mix equal parts of the purest blue and yellow pigments (c) and (d), we get not gray, as with blue and yellow lights, but a green of medium brightness (e). Adding more yellow, we get a yellower green (f); adding more blue, we get a bluer green (g).



Our perception of a color is more influenced by its surroundings than we usually realize. The same green appears bluer on the yellow background and yellower on the blue background.



For the most part, we assume naïvely that things are the color they appear to be, and we are unaware of the indirect attracting or repelling effect that different colors have on us. Food merchandisers are well aware of this effect of appearance on the "invitingness" of the food they wish to sell. Here you see the same slice of meat photographed under two conditions of illumination. Which would be most likely to stimulate sales?



Color, effectively used, has been found to improve morale of workers, lessen fatigue, and more than pay for itself in better production and lowered accident rates. In these pictures of the Government Printing Office before and after remodeling, we can see how much color can do to conceal unattractive pipes and ducts, lighten and brighten the equipment for better visibility, and make the room an attractive one in which to work.

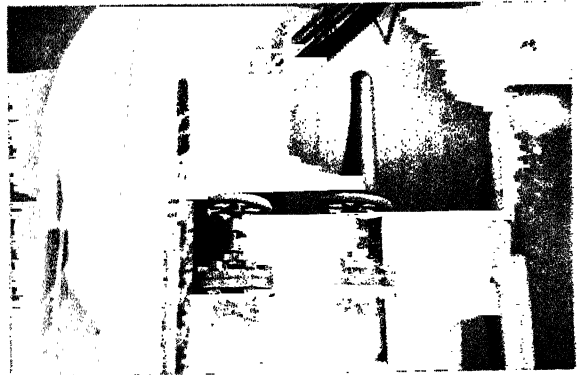
Colors used as signals and warnings are essential in modern living. We seldom stop to think, however, that in order to respond to such signals, we need to be able not only to see and distinguish the various colors, but also to be able to receive and distinguish successive patterns of stimulation from one split-second to the next. This is what a railroad engineer would see if his eyes were not able to discharge successive sensations almost as fast as they are received.

(Photograph by Arthur Siegel.)



This "Hortonsphere" of the Standard Oil Company of New Jersey illustrates the functional way in which color is being used increasingly in industry. Emergency pipe handles are painted bright yellow for immediate visibility. The tank itself, constructed of thin-gauge steel illustrates the familiar "luster" of metal. Objects have not only color but various "surface characteristics" which are part of our perception of them.

(Photograph by Arthur Siegel.)



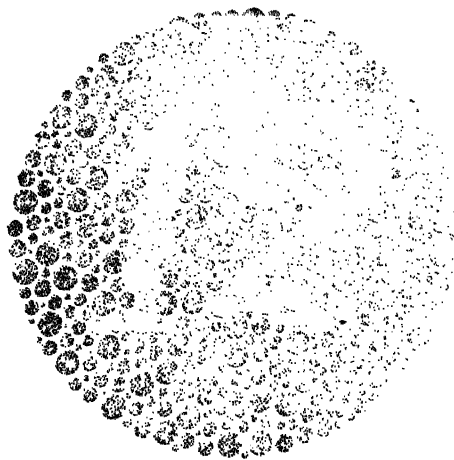


plate 1

Plate 1. Both color-blind and normal people read this figure as 12.

One of the best known and most widely used tests of color blindness is the Ishihara, four plates of which are reproduced here. The series, now in its tenth complete revision, contains thirty-eight plates in all and is so designed that it can not only distinguish color blindness from normal color vision but can also distinguish between the most common forms of color blindness.

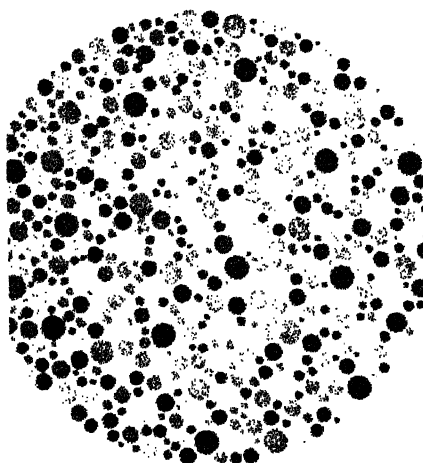


plate 2

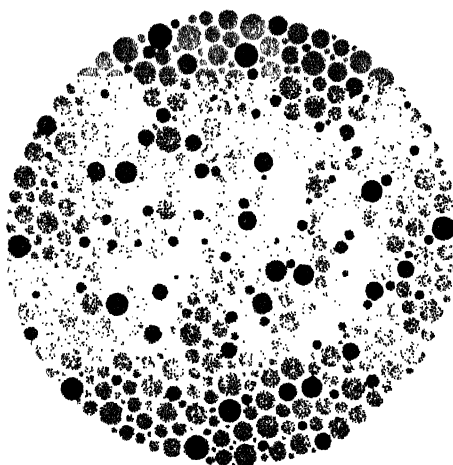


plate 20

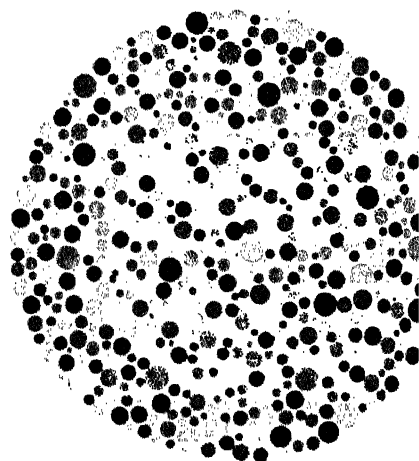


plate 22

Plate 2. The normal person sees the figure 8. The red-green-blind person sees the figure 3. The totally color-blind person sees no figure.

Plate 20. Most red-green-blind people see the figure 45. Most normal and totally color-blind cannot read it.

Plate 22. The complete red-blind person sees only the figure 6. The complete green-blind sees only the figure 2. Normal and incomplete red-green-blind read 26.

color vision. Perhaps the most widely known is the *Young-Helmholtz theory*, proposed by Thomas Young in 1801 and later modified by Helmholtz. According to this theory, the human eye contains three kinds of cones, each kind being sensitive to one of the three primary colors of light. When all are stimulated equally, a sensation of white results. Other color sensations result from combined stimulation of the three types of cones in different proportions. Thus this theory accounts for the fact that different mixtures of wave lengths yield different color sensations.

It also accounts for *negative after sensations* (also called *afterimages*). If we look fixedly at a green object, the photochemical substance in the cones sensitive to green light is acted upon. Later, when we look at a white surface, the red and blue receptors, having been acted upon to a much lesser extent, respond in greater proportions to the white light, causing us to perceive a patch of reddish purple as a negative after sensation. After sensations will be further discussed on page 248.

Certain aspects of the Young-Helmholtz theory have been proved erroneous. For instance, Helmholtz believed that specific nerve fibers and specific areas of the cortex of the brain were activated by specific color responses in the cones, but this has been shown to be false. In general, recent neurophysiological and anatomical knowledge suggests that the Young-Helmholtz theory is somewhat oversimplified (Ruch, 1955). However, modern research bears out the view that different types of cones are responsible for different color sensations. A recent experiment dealt with a type of cone known as the "violet receptor." Its presence is indicated by the fact that after exposure to orange light the eye is more sensitive to violet light than to orange—the reverse of normal cone vision (Auerbach and Wald, 1955). The probable explanation for this is that the violet receptors rest while the orange light is striking the eye; they then have a lower than normal threshold of sensitivity to violet light during the first two minutes of dark adaptation. After that time, sensitivity to orange light again becomes greater.

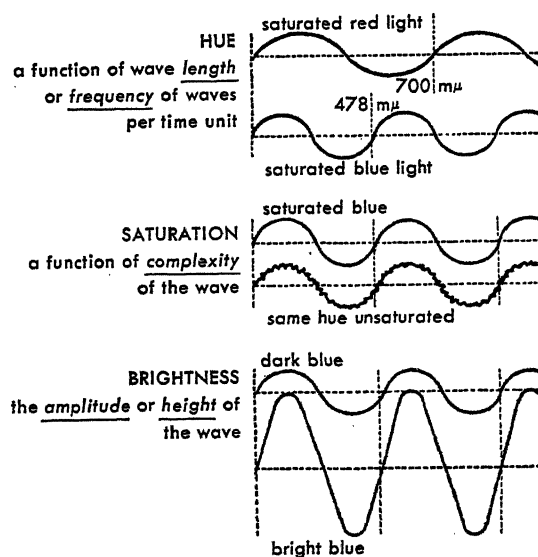
Today most psychologists would agree that there are at least three types of cones, as suggested by Young and Helmholtz. Among investigators who believe that there are more than three types of cones, some accept the "cluster" hypothesis of color vision. According

to this view, cones of a given type tend to be found in groups or clusters, each cluster sensitive to a particular color of light (Hartridge, 1947). More research is necessary, however, before we can determine exactly how the cones function.

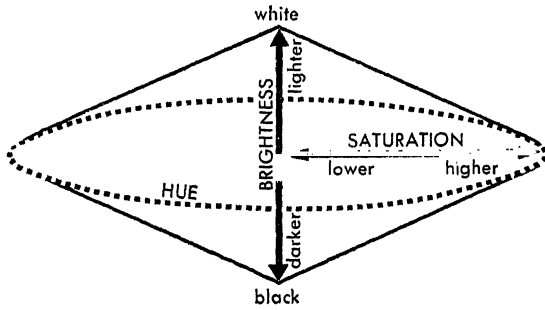
The qualities of color. Suppose you were asked to describe the clothes worn by a couple whom you had seen at a party the night before. You might say, "Ralph was wearing a dull, grayish-blue suit and a deep red tie; and Janice was wearing a pale pink dress." Even in this simple description of colors, you would be referring to all three qualities of color: hue, saturation, and brightness.

Hue. When we speak of Ralph's suit as blue and his tie as red, we are discriminating between these colors on the basis of the different *frequencies* of the light waves reflected from those articles of clothing. Thus *wave frequency* is the physical stimulus, and *hue* is the resulting sensation. (The diagram below will help clarify the physics of the stimulus of hue.) The *linear distance* from a point on one wave to the corresponding point on the next wave is its *wave length*. Thus Ralph's tie reflects light waves of greater wave length than does his blue suit. Wave lengths of light are so small that we generally measure them in units of millionths of a millimeter ($m\mu$). Just how

Wave Properties of Hue, Saturation, and Brightness



The Color Solid



our receptor cells are tuned to these different wave lengths—that is, how we perceive color—is still unexplained.

Saturation. When we speak of Ralph's suit as a dull, grayish blue, we mean that the color is not highly saturated with blue. The rich red of his tie, on the other hand, is a saturated color. In terms of light waves, the saturation of a color is determined by the complexity of the light waves emanating from an object. The light waves coming from the dull-blue suit contain not only light waves which would produce the sensation of blue hue but also some other light waves which, by themselves, would produce a gray. Thus the color appears relatively unsaturated.

Brightness. Still a third quality of color is shown in the pink dress worn by Janice. Pink is only another name for light red; that is, it is the same hue as red but differs from red in brightness. This quality is not to be confused with saturation, although many commonly used pinks are somewhat desaturated. As its brightness decreases, pink more closely resembles red. However, as its saturation decreases, pink of a given brightness becomes grayish and is often called "dusty pink."

As we would expect, the brightness of a color sensation is influenced by the nature of the wave lengths. In this case, the amplitude (or height) of the wave is the determining factor. The waves from Janice's dress and Ralph's tie have the same length, but those from the dress have greater amplitude.

Other factors also influence the brightness of a color. One of these is the intensity of the illumination. For instance, when we look at an object under a bright light, we temporarily cause an increase in the apparent brightness of the color. And in illumination too dim for the cones to function, where colored objects appear gray, blue or green objects may be seen as a brighter gray than

yellow ones. This is an example of the Purkinje effect, mentioned on page 238. In bright light, of course, yellow seems brighter than a blue of the same physical intensity because the cones are more sensitive to yellow than to blue and green.

The color solid. Suppose you wished to show in a diagram how all the innumerable colors could be classified. You might start by indicating degrees of saturation on a horizontal line and degrees of brightness on a vertical line. But where would you show hue? You would find that, in order to classify colors adequately, you need three dimensions. Scientists have constructed just such a three-dimensional figure, which is known as the *color solid*. (See the diagram at left and the color illustrations on Plates II and III of this book.) The color solid is a double cone shaped much like a child's top. All combinations of hue, saturation, and brightness lie within its boundaries. Points along the circumference represent the different hues, while points along the vertical axis represent degrees of brightness. Toward the upper end of the solid, the colors become lighter and lighter until white is reached. Black, as the darkest color, is at the lower end of the axis. At the outer edge where the circumference is greatest, the colors are saturated. They become less and less saturated toward the center. Thus we can say that points along the radius of the color solid represent degrees of saturation. You can see this more clearly by examining the picture of a cross section of the color solid (Plate III), cut out at right angles to the axis.

Such a cross section is known as a *color wheel* and is particularly useful in showing relations between hues. The various hues are represented by segments around the rim of the wheel, ranging from red to violet. All these hues are found in the spectrum except purples, which must be produced by combining spectral lights. Of course, these pictures are simplified; in reality the colors merge gradually into each other around the wheel. As you can see, they become grayer toward the center of the wheel, which is also the central axis of the double cone. In fact, at the center of the cone there is gray, and all along the central vertical axis we find shades of gray, representing zero saturation. It so happens that the brightest and darkest colors are the least saturated, so that the very brightest and darkest points, at the top and bottom of the

color solid, are also points of zero saturation—that is, they fall on the vertical axis. This is why the color solid is a double cone and not a cube or a sphere. It must taper to a point at top and bottom. Also, the highly saturated colors are of medium brightness. So, at the midpoint of the up-and-down brightness axis, the color solid is widest, with the greatest range in saturation from the center to the outer rim.

Combining colors. What happens when two hues are combined? This question is not so simple as it sounds, for there are several ways in which colors can be combined. The diagrams on Plates IV and V of this book demonstrate some of the important facts about color mixture and color contrast.

Combining light and combining paints. We must first make clear the distinction between combining colored lights and combining or mixing paints. The laws of light mixture are sometimes the same as, and sometimes quite different from, those of paint and dye mixing. As a child you doubtless discovered that by mixing blue and yellow water colors you could get green for painting grass or trees. Suppose, however, that you are now on a lighting crew for a college play and you need a green light. Remembering your earlier experience, you may mix blue and yellow light. What is the result? Gray, not green. The reason we get such different results in mixing light from in mixing paints is complex. Briefly, it is a matter of adding or subtracting wave lengths. When blue and yellow *light* are mixed, they are *added* together. When yellow and blue *pigments* are mixed, however, all the wave lengths are absorbed by the paint except those which give rise to a sensation of green. Thus, when we mix pigments, many wave lengths are *subtracted* through this process of absorption.

How, then, can you obtain your green light? If you must depend upon mixing other colors of light, you simply are out of luck. For green—together with red and blue—is one of the *primary colors* of light. This means that these three colors cannot be derived from any other color but that they can, when mixed in different proportions, produce all other colors. The primary colors in pigment, on the other hand, are red, blue, and yellow.

Still another kind of primary color can be seen on the color wheel. As you look at the various hues, some seem to be more “fundamental” than others—that is, you cannot break

them down into two or more component hues. The yellows, blues, greens, and reds seem more stable than the oranges, purples, yellow-greens, and blue-greens. No matter how long or how hard you look at the yellows, blues, greens, and reds, they resist analysis into anything else. In the orange, however, you can see red and yellow; in the purple, red and blue; in the blue-green, blue and green; and in the yellow-green, yellow and green.

The four stable, irreducible hues are called *psychological primaries*, because we cannot consciously analyze them into more basic elements. They should not be confused with either the three primary colors of the artist's pigments or the three primary colors of light mixture. Psychological red is not even found in the spectrum of daylight but is produced by adding psychologically primary blue to the red of the spectrum (Dimmick and Hubbard, 1939).

Our discussion of color combinations will cover: (1) the laws of additive (light) color mixture, (2) simultaneous contrast effects, and (3) negative and positive after sensations.

The laws of additive color mixture. There are two simple laws which describe the results of mixing lights of the same brightness but of differing hue. These are illustrated on Plates IV and V and may also be determined by looking at the color wheel.

LAW I. Any two hues opposite each other on the color wheel combine to produce gray. Examples of such combination are yellow fused with blue; red-blue fused with green; red fused with blue-green. Two colors which combine to give gray are called *complementary colors*.

LAW II. Other hues fuse to produce different hues or blends. In each case the two hues combine to give a hue which lies between them on the color wheel. Examples of this type of mixing are found in the following combinations and results: red fuses with yellow to produce orange; red with blue to produce purple; red with green to produce yellow; blue with green to produce blue-green.

To find the results of the mixture of any two colors, refer to the color wheel. Merely draw a line from one color to the other. The midpoint of the line will show you the hue that results when these two colors are mixed in equal proportions. For example, the center of the line passing from yellow to blue falls at the hub. And we have just seen that these

two complementary colors fuse to give gray. The degree of saturation of the resulting combination can also be determined roughly from the color wheel if the saturations of the colors being combined are known. For instance, green and red mix to give yellow of low saturation. On the color wheel a line connecting the green and the red runs through the yellow sector but toward the center where saturation is low.

When the hues are not mixed in equal proportion, the resultant hue and saturation correspond not to the midpoint but to some point determined according to the relative proportions of the two colors used.

A color wheel, since it is a cross section of the color cone, contains only two of the three "dimensions" of color: hue and saturation. It can summarize only the results of mixing hues of differing saturation but identical brightness. When the third dimension of brightness is added, the problem becomes more complex. When a hue of low brightness is mixed with a hue of high brightness, the result is an intermediate hue of intermediate brightness. The same is true of black and white, which combine to give gray.

Simultaneous contrast effects. If you place a strip of gray paper on a yellow background, you will observe that the gray becomes blueish. If you place the same piece of gray paper on a blue background, it will take on a yellowish cast. The apparent change of hue is known as the phenomenon of *simultaneous hue contrast*. The gray paper always appears to take on the complementary hue of the color in the background. (Remember that two complementary colors, when mixed, give gray.) *Brightness contrast effects*, similar to those of hue, can also be simply produced. A gray figure against a background of white seems darker than the same gray figure against a field of black. All such contrast effects are called "simultaneous" because the original hue (or brightness) and the contrasting hue (or brightness) are seen by the eye at the same time, side by side.

Negative and positive after sensations. "After sensations," as the name implies, are so called because a second color sensation follows the original color sensation. If you gaze long and hard at a bit of yellow paper, not allowing your eyes to waver, you will notice that the borders of the paper soon take on a bluish tinge. The yellow itself seems to fade, to lose saturation. After these effects are quite clear-

ly observable, look at a piece of clean white paper and you will see a patch of blue, which is complementary to the original yellow. This is called a negative after sensation because you see a hue complementary to the hue of the original.

A negative after sensation will mix with a currently perceived color to give results predictable through the regular laws of color mixture. For example, we have seen that the negative after sensation of yellow is blue. If that blue is projected on orange paper, the orange of the paper and the blue of the negative after sensation will combine to give red-purple.

Positive after sensations—of the original rather than the complementary hue—also occur after an interval of stimulation. Gaze at an electric light for a time and then blank it out with a piece of paper. For a short time the original light will appear to glow yellow before your eyes.

Another contrast effect is produced by looking intently at a surface of a particular hue and then gazing at a surface of complementary hue. In this case the second hue is seen as more saturated than it would normally be. In fact, the fullest saturations are obtainable only by first looking at the complementary hue.

SEEING COLORED OBJECTS

The classification of color sensations in terms of brightness, saturation, and hue is by no means all-inclusive. Visual sensations have certain other characteristics such as a glow or luster, bulk, and surface quality. These are called *modes of appearance*. The artist, in his attempts to reproduce the colors of nature, is restricted to the use of hues having surface quality. It is for this reason that his skies, seas, and sunsets can never seem quite real.

Colors also have various psychological associations. For instance, red, orange, and yellow are called *advancing colors* because they appear to be nearer to us than the other colors. They also suggest warmth. Green, blue, and blue-green suggest coolness and are known as *receding colors*.

Even more complex qualities are attributed to colors. Indeed, they seem to express a wide variety of mood-tones, as indicated in a recent study conducted with students in a beginning psychology course (Wexner, 1954). To see how well your ideas about color and

mood agree with those of the students in this study, choose from the following colors the one you would associate with each of the mood-tones listed below: yellow, orange, red, purple, brown, blue, black, green. Check your answers with those given in the table on page 250.

- | | |
|---|-------|
| 1. Exciting, stimulating | _____ |
| 2. Secure, comfortable | _____ |
| 3. Distressed, disturbed, upset | _____ |
| 4. Tender, soothing | _____ |
| 5. Protective, defending | _____ |
| 6. Despondent, dejected,
unhappy, melancholy | _____ |
| 7. Calm, peaceful, serene | _____ |
| 8. Dignified, stately | _____ |
| 9. Cheerful, jovial, joyful | _____ |
| 10. Defiant, contrary, hostile | _____ |
| 11. Powerful, strong, masterful | _____ |

COLOR BLINDNESS

The essential difference between color-blind and normal persons is that hues which appear different to the normal person look the same to the color-blind. John Dalton, the eminent British chemist, was the first to recognize this defect. Color-blind himself, he described his sensations of color in 1794, stating that blood looked to him "not unlike the color called bottle green."

Color-blind persons frequently do not know that they suffer a defect of vision unless they have been tested and informed of the result. They see all the objects that other persons see and have learned to call those objects by the same names that others use. Furthermore, color blindness is not on an all-or-nothing basis. People vary from strong color vision through many degrees of what might be called "color weakness" to the very rare state of complete color blindness. Probably about 4 per cent of men suffer some degree of color blindness, whereas only about one woman in a thousand is color-blind. Interestingly enough, however, a man's color blindness is transmitted through his daughter (in recessive form) to any sons she may have.

The classification of color blindness is far from perfect. The principal defect in current systems is that they fail to measure and express the various degrees of color blindness in sufficiently fine categories. The standard procedure, which is of great practical useful-

ness, is to consider that there are two kinds of color blindness: *total color blindness* and *dichromatic color vision*.

Total color blindness. Total color blindness is extremely rare, occurring in one among forty thousand people. To date, only a few dozen such cases have been described in scientific literature. It is believed that their defect arises from a complete lack of cones in the retina, so that they must rely entirely on their rods for both day and night vision. Their lack of cones shows itself in the fact that they are usually completely blind in the fovea, ordinarily the area of greatest color sensitivity. In examining an object they have to keep shifting their gaze in order to keep the image from falling on their blind foveal area. Totally color-blind people are highly sensitive to light—so much so that bright light causes great discomfort.

Dichromatic color vision. The word *dichromat* comes from two Greek words: *di* meaning "two" and *chroma* meaning "color." A *dichromat* is a person who has normal vision for two primary colors, usually yellow and blue. He sees these in all degrees of saturation and can also distinguish white through all shades of gray to, and including, black. He has a color weakness or color blindness, however, for shades of red and green. Obviously such a person suffers a severe limitation of visual ability in comparison to the normal person. Red and green traffic lights used to be confused by dichromats, but now that blue has been added to the green and orange added to the red, the dichromat can tell the lights apart. The intensity and position of the lights also give the color-deficient persons the needed clues for recognizing the traffic lights. Many persons who have a dichromatic color weakness can distinguish reds and greens of high saturation and have difficulty only with pale, washed-out colors.

Testing for color blindness. One of the simplest tests of color vision is the yarn-matching test, in which the subject is asked to match yarns on the basis of color. The person with red-green blindness, for example, can be detected when he throws red and green tufts of yarn into the same pile. Although this test has the advantage of simplicity, it is subject to error because the yarns differ from each other in brightness as well as in hue and can often be matched on the basis of brightness. The fact that the yarns fade and lose saturation also adds to the diffi-

Mood	Most Frequently Named Colors	Number of Students
1. Exciting, stimulating	Red	61
	Yellow	12
2. Secure, comfortable	Blue	41
	Brown	23
3. Distressed, disturbed, upset	Orange	34
	Black	16
4. Tender, soothing	Blue	41
	Green	24
5. Protective, defending	Red	21
	Brown	17
6. Despondent, dejected, unhappy, melancholy	Black	25
	Brown	25
7. Calm, peaceful, serene	Blue	38
	Green	31
8. Dignified, stately	Purple	45
	Black	30
9. Cheerful, jovial, joyful	Yellow	40
	Red	20
10. Defiant, contrary, hostile	Red	23
	Orange	21
11. Powerful, strong, masterful	Black	48
	Red	23

These were the answers given by ninety-four general psychology students who were asked to name a color to fit the mood-tones on page 249. Only the most frequently named colors are given, with the number of students naming each of them.

culty of keeping the test standard. (A more satisfactory variant of the matching test makes use of metal chips coated with non-fading plastic paint.)

Tests built on the principle that color-blind people distinguish red from green only by their relative brightness are those of Stilling, a German, and Ishihara, a Japanese. Typical color plates in the Ishihara test are illustrated on Plate VIII of this book. One of them contains a red figure 8 against a green background. Both figure and background are composed of a pattern of various-sized dots which differ slightly in color and brightness. The left half of the 8 is the same brightness as the background, so that a colorblind person cannot see it. But the right half differs in brightness and will be seen and read by the red-green color-blind person as the figure 3.

A simple device that shows immediately which colors are confused by the different types of color defectives has been invented recently by Lt. Comdr. Dean Farnsworth of the Navy's Medical Research Laboratory at the New London Submarine Base (Farnsworth, Sperling, and Kimble, 1949). A person who is extremely color-deficient will match a gray spot on a transparent disk with a red, violet, or green spot on a master diagram beneath. Others, not quite so color-deficient, will say the gray doesn't really match any of the spots but looks closer in hue to one than to the others. In this way the device indicates which colors the observer confuses.

An even more recent test, known as the Hardy-Rand-Rittler or H-R-R test, has compared favorably with the Ishihara and Farnsworth tests in its ability to show both the nature and the extent of color deficiency (Hardy, Rand, and Rittler, 1954). It is based on the same general principle as the Ishihara test but uses colored triangles, circles, and squares instead of numbers. For this reason, the H-R-R test has the advantage of being useful for illiterate persons or children who have not yet learned their numbers. Also, in this test the hundreds of dots on each chart are arranged in exactly the same pattern. This makes it impossible for anyone to "beat the test" by memorizing patterns of dots. By using the hues most likely to be confused with gray in graded steps of saturation from faint to strong, the test indicates several degrees of color deficiency as well as showing the type of color deficiency present. Anyone who correctly names the figures on the first half-dozen plates is almost certain to have good color vision.

Can color blindness be cured? Some people have claimed that Vitamin A has cured their color blindness. Whereas Vitamin A *does* improve visual acuity and night vision, it has no proved effect on color blindness. It is possible, however, that some partially color-blind people have been able to pass a color-vision test after taking Vitamin A because of increased visual acuity, which can sometimes push a borderline case over the line.

Another factor which must be considered is that doctors do not agree perfectly in interpreting the results of an examination for color vision. In fact, the experience of the Civil Aeronautics Authority with civilian pilot candidates is that 50 per cent of the

candidates rejected for color blindness by the first examiner are accepted by the second examiner working independently (Viteles, 1944).

A third complication is the fact that practice in taking the test may improve ability to pass the test without changing the basic ability to see differences in hues. The subject may memorize, for example, what he "should" see on the test plates—that is, he will remember that the figure he sees as a 3 actually is a red 8 on a green background. "Color-vision trainers" also make use of the phenomena of simultaneous and successive color contrast. It is possible with a red-green color-weak retina to bring up the saturation of the red by staring for a while at green, its complementary color, or its near complement. On the Ishihara plate mentioned, for example, the subject may be able to make the red "come up" in the crucial part of the figure 8 by staring at the green background for a time and then focusing on the figure.

Present evidence indicates that we had better restrain our enthusiasm for "cures" of color blindness until careful research has revealed more about its varieties and causes.

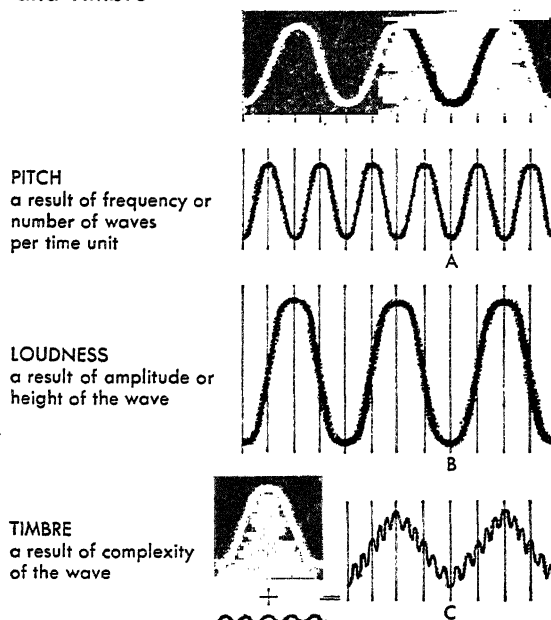
HEARING

Although we are not always conscious of it, the sense of sound plays a vital role in most of our vocational and avocational activities.

PHYSICAL AND PSYCHOLOGICAL BASES OF SOUND

When an object produces sound, its surfaces vibrate rapidly back and forth, thus disturbing the surrounding air and creating waves of *pressure differences*. These alternating waves of dense and thin air are the stimuli for hearing. As it vibrates in one direction, the object pushes *against* the surrounding air and compresses it; in the other direction, the object moves *away* from the air and thus tends to thin it. As the vibrations continue, this cycle repeats itself and the alternating high and low-pressure areas—or sound waves—are directed away from the object at high speed. Only the *pressure* areas move; the air particles themselves remain almost stationary.

Wave Properties of Pitch, Loudness, and Timbre



Comparison of waves A, B, and C to the basic wave at the top of the diagram will help illustrate the properties of waves. Wave A has twice the frequency of the basic wave and hence is higher in pitch; wave B has twice the amplitude or height of the basic wave and therefore is louder. The moment-by-moment addition of a weaker and higher wave to the basic wave produces the complex wave C.

The sound waves produced by the vibrations of an object vary in their *frequency*, *intensity* (pressure), and *complexity*. These three aspects of the auditory stimulus produce corresponding dimensions of sound: *pitch* (tone), *loudness* (volume), and *timbre* (quality). The chart below shows how the dimensions of sound parallel those of color and how each is related to a corresponding wave characteristic.

Physical Characteristic of Light or Sound Wave	Dimension of Color	Dimension of Sound
frequency	hue	pitch
amplitude, or intensity	brightness	loudness
complexity	saturation	timbre

Pitch (tone). Pitch refers to how high or low a note sounds. It is related primarily to the

frequency of vibrations and is expressed in *cycles per second*. Each piano string, for example, has a characteristic rate of vibration when struck—a faster rate for the shorter strings, a slower rate for the longer ones. A string vibrating at around 16 cycles per second is as “low” as the human ear can hear. The highest notes we can hear are produced by vibrations at 24,000 cycles per second. These figures are for loud tones only; our range of hearing decreases with every decrease in loudness.

Loudness (volume). Loudness is determined primarily by the amount of air pressure *difference* between the compressed part of the wave and the rarefied part. It is the aspect of an auditory sensation which we describe in the terms “weak” and “strong.” A sound stimulus may be so weak that it will not produce any auditory sensation whatever; we refer to such a sound as being below the threshold of hearing. At the other extreme, a sound stimulus may be so strong that the resulting sensation is one of pain rather than hearing.

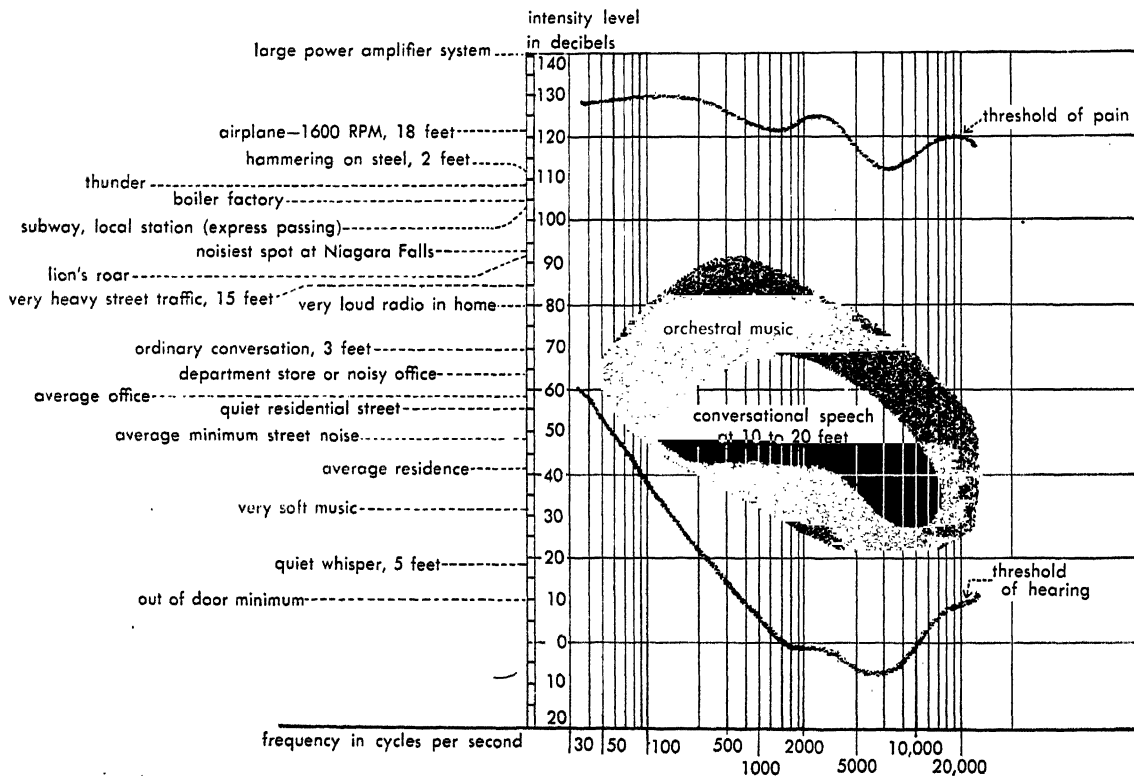
The range of pressures to which our ears are sensitive is enormous. The ratio of the

least to the greatest pressure producing auditory sensations is about 1 to 5,000,000. Because of the large range of actual sound pressures, auditory intensity is usually measured in a more convenient unit known as the *decibel*. The decibel measures the intensity of a particular sound in terms of *how many times more intense* it is than a sound at the lower threshold of hearing. This threshold depends not only on the *intensity* of a wave, but also on its *frequency*. Zero on the decibel scale has been fixed to represent the least intense stimulus we can hear at a frequency of 1000 cycles per second.

The chart below shows on a decibel scale the comparative loudness of many familiar sounds. Again, the number of decibels of a particular sound does not tell us the *actual* difference between the intensity of this sound and one of zero decibels but rather represents the *ratio* of one to the other. (The number of decibels is calculated by multiplying the logarithm of this ratio by twenty.)

Although the threshold of pain is not reached until 115 to 130 decibels, sounds upward of about 80 decibels are unpleasant for

Loudness of Familiar Sounds



most people. The threshold of pain—like that of hearing—depends on both the intensity and the frequency of the sound waves.

Timbre (quality). Most tones are complex rather than pure; that is, the fundamental tone is combined with weaker ones called *overtones*. A wire four feet long, for example, will vibrate as a four-foot wire to produce its fundamental pitch. But it will also vibrate simultaneously as two two-foot wires—each such vibration producing other tones far less audible than the fundamental one. To a much lesser extent, it will vibrate as four one-foot wires, producing even fainter sounds. These overtones (also called *partials* and *harmonics*) are included in the tone we hear and help to make up its quality, or *timbre*. The difference in quality between a middle C on a flute and on a violin results from differences in the complexity and arrangement of the overtones that each instrument produces because of its material and design and the manner in which it is played.

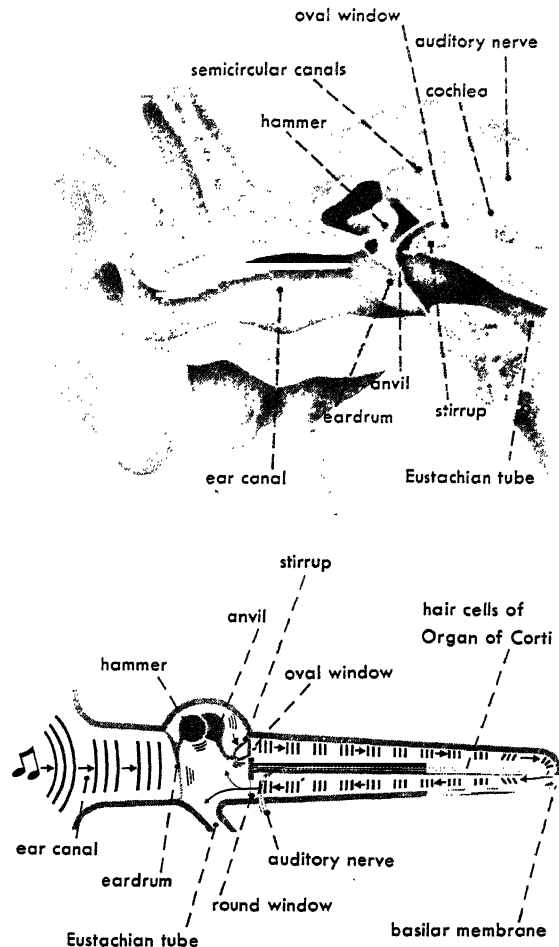
The sound waves produced by a musical instrument repeat themselves in a regular pattern, as shown in the illustration below. The auditory sensation created by such regular waves is a pleasant one. Many objects, however, produce waves of irregular and unrelated frequencies. This results in the sensation of *noise*, sometimes defined as “unwanted sound.”

THE HUMAN EAR

To understand hearing and its defects, we must know something of the anatomy of the ear. The drawings above portray the structure of the various parts of the human ear and indicate how they function.

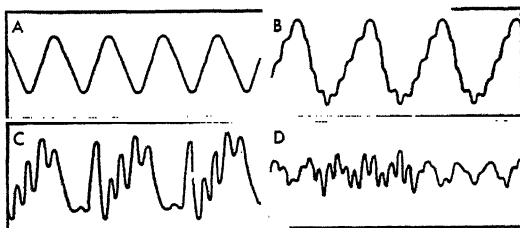
Pressure fronts into nerve impulses. In traveling to the auditory center of the brain,

Structures of the Ear



The top drawing is a cross section view of the human ear. Below it is a diagrammatic cross section with the cochlea as it would appear if it were unwound and stretched out straight. Sound waves enter the ear canal and push and pull against the eardrum. The vibrations are transmitted mechanically to the membrane of the oval window and then travel through fluid along the pathway indicated by the arrows until they reach the receptor cells in the Organ of Corti.

Sound Wave Forms Produced by Different Instruments



A, tuning fork. B, violin. C, oboe. D, clang of a bell.

sound impulses must pass through three principal parts of the ear: (1) the external ear; (2) the middle ear; and (3) the inner ear, where these sound impulses are finally transformed into nerve impulses.

1. The waves of pressure travel first through the outer ear and auditory canal to the thin membrane called the *eardrum*.

2. The eardrum is made to vibrate by the pressure impulses. It in turn transmits the

motion to three hinged bones—the *hammer*, *anvil*, and *stirrup*—located in the tympanic cavity of the middle ear. This cavity is supplied with air by the Eustachian tube, which leads in from the throat and makes it possible for us (by swallowing) to equalize the pressure on the two sides of the eardrum. The movements of the stirrup are transmitted to the *oval window*, a membrane separating the middle and inner ears.

3. Vibration of the oval window forces movement of the fluid in the three *cochlear canals*. The movement of the fluid, in turn, stimulates the basilar membrane; this excites the hair cells of the *Organ of Corti*—a thickening of the basilar membrane at the floor of the cochlear duct (one of the canals). The movement of the hair cells stimulates nerve impulses in the fibers associated with the hairs; and finally these impulses travel through the *auditory nerve* to the brain, where they are translated into the sensation of hearing.

The basilar membrane varies in width from one end to the other, and different areas of it respond to vibrations of different frequencies. Where it is narrowest (at the wide end of the cochlea near the oval window) it responds most easily to waves of high frequency; as the membrane widens, it becomes increasingly responsive to impulses of lower and lower frequency. Thus the basilar membrane seems to be largely responsible for the fact that differences in wave frequency can be transmitted to the brain and give rise to sensations of different pitch. This membrane is truly a precision instrument. It moves in a

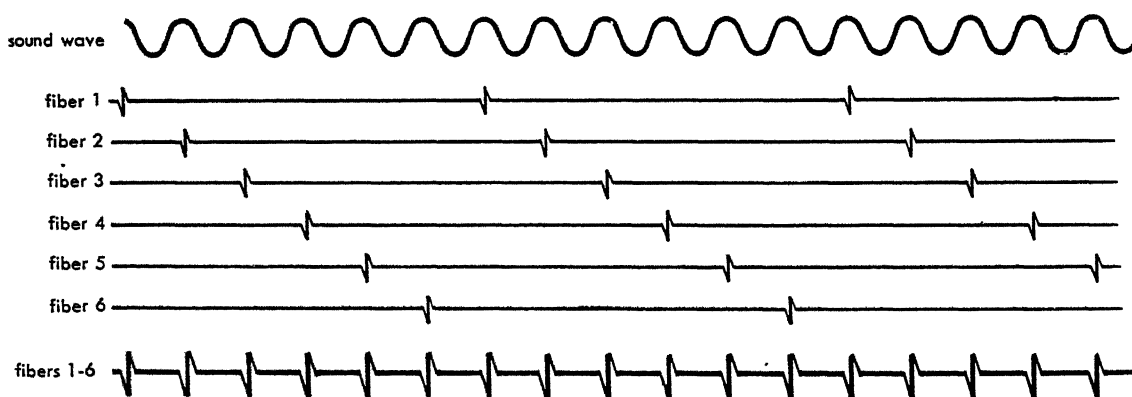
controlled and predictable manner, but the extent of its movement is very small indeed. At the threshold of hearing the basilar membrane is calculated to move a distance about equal to the diameter of a hydrogen atom. Students of chemistry will know that this is not very far.

Nerve impulses into sensations. For a long time physiologists and psychologists were unable to explain the relationship between the various characteristics of the auditory stimulus and those of the auditory sensation in terms of the known facts of neural activity.

According to the *place* or *resonance* theory first suggested by Helmholtz around the end of the nineteenth century, the transverse fibers of the basilar membrane are a series of resonating strings tuned, like the strings of a piano, to different frequencies. A particular tone causes a particular fiber of the membrane to vibrate sympathetically, and this in turn excites a receptor cell located at the same place. Stimulation of the cell starts a nerve impulse that gives rise to the sensation of a particular pitch. The loudness of the sensation, according to Helmholtz' theory, supposedly was determined by the frequency with which the nerve fiber responded. The most serious difficulty with the resonance theory is that the transverse fibers in the basilar membrane are not separate strings. In addition, many doubt whether different fibers could account for as many different tones as our ears differentiate.

To meet some of the difficulties of the place theory, various *frequency* theories have been developed. Typical of these was the

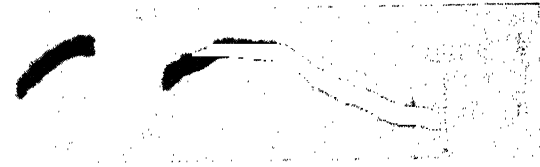
Volley Theory



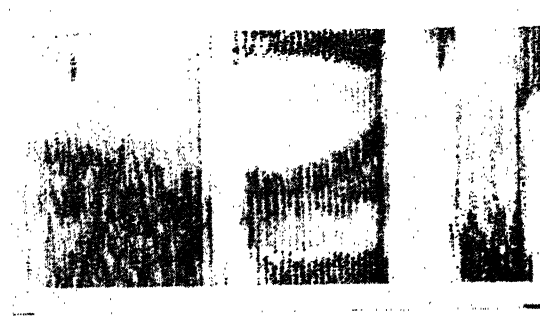
(after Wever 1949)



Wolf whistle



"Visible speech"



The Bell Telephone Laboratories has developed techniques by which the human voice can be electronically analyzed and presented as a series of pictures on a fluorescent screen. Every sound has a characteristic pattern by which it can be identified, as in the above examples. With training in this "visible speech," two deaf persons can converse with each other, as shown above, although they cannot hear each other's voice. More important, however, is the fact that this system enables the deaf person to catch speech differences due to dialects and differences in timing and emphasis, which add emotional content to speech; thus it can help him improve both his "hearing" and his own speech.

telephone theory suggested by the British physicist Rutherford, who held that the frequency of nerve impulses was directly correlated with the frequency of the sound wave. Thus the basilar membrane was thought to play a role similar to that of the telephone transmitter, simply relaying these impulses of various frequencies to the brain. This theory held that the loudness of an auditory sensation was determined by the number of nerve fibers excited, which in turn depended on the intensity (or amplitude) of the original sound wave. The basic error of the telephone theory is that it assumes that a particular nerve fiber can respond at any frequency, whereas all available evidence indicates that the maximum frequency with which a single nerve fiber can respond is no more than 1000 times per second. Obviously, then, it cannot transmit all frequencies within the range of hearing, for these may be as high as 24,000 cycles per second.

A theory which helped reconcile these earlier theories of hearing was the *volley* theory, first developed around 1930 (Wever and Bray, 1930). It was especially helpful in explaining the fact that we can hear fre-

quencies much higher than the maximum frequency of nerve fiber discharge, for it suggested that the nerve fibers operate in groups and that the various groups react—or discharge their volleys of impulses—at different times. If a tone of four thousand cycles per second were being transmitted, for example, there would be a spurt of activity in the auditory nerve every four thousandth of a second, or once for every peak in the sound wave—but different groups of fibers would be responsible for the spurt each time. Some fibers might react to every fourth cycle of the sound wave, some to every fifth cycle, some to every sixth, and still others even less often. See the chart at left.

Although the various fibers differ thus in excitability, at least some of them will discharge their impulses every time a peak in a sound wave occurs. There will be some discharges between peaks, but on the whole there is a marked spurt of nerve impulses for every condensation and a low point for every rarefaction of the stimulus. Thus the volley principle—actually a modified frequency theory—explains how a bundle of nerve fibers can reproduce the frequency of the



Deaf since birth, the little girl wearing earphones squeals with joy as she hears her teacher tell her that her toys are "blocks." The other child, also deaf, is waiting to hear herself beat the drum. Even "totally deaf" children nearly always have some hearing. At the Smouse Opportunity School in Des Moines, Iowa, deaf children are taught the meaning of words through the use of a powerful amplifier which can deliver, with virtually no distortion, up to 130 decibels (almost twice as loud as a normal listener can comfortably stand). Then the children can imitate the sounds and thus learn how to speak. After that they learn to "hear" by reading lips.

original sound wave even though no single fiber is able to respond to its every peak.

The latest evidence seems to indicate that both a volley theory and a place theory are needed to explain hearing. For frequencies up to five thousand cycles the volley principle seems to be the major factor, but above five thousand cycles the experience of pitch can be explained only by the place principle. The development of this place-volley theory of audition illustrates how, as human knowledge increases, conflicting explanations of behavior can sometimes be resolved into a single adequate theory (Wever, 1949).

DEAFNESS

Fortunately, few people are entirely deaf. For the less seriously handicapped, there are devices that amplify sounds till they can be heard fairly easily. Those whose hearing loss is more severe sometimes use devices that translate the vibrations of sound into sensations of touch, thereby enabling the deaf to substitute their cutaneous senses for the

sense of sound. The sense of sight, too, can help compensate for a hearing loss. Reading lips is an ancient and successful substitute in face-to-face communication. Recently, technicians at Bell Laboratories have devised complex equipment which translates speech sounds into definite visual patterns that can be learned.

Although we usually think of deafness simply as "inability to hear," there are really many kinds of deafness.

Intensity deafness. Many people are "hard-of-hearing" in the sense that they cannot detect faint sounds that are easily heard by normal persons. Intensity deafness is often an occupational disease. Aviators and boiler-makers, for example, often become partially deaf from the loud noises to which they are constantly subjected. Many gunners and mortar-men of World War II and the Korean War have suffered hearing losses in the higher ranges, accompanied by more or less permanent ringing in the ears (*tinnitus*). Generally it has been found that the anti-aircraft and intermediate caliber guns do considerably more auditory damage than the heavy bombardment and coastal defense guns.

Whether or not the ears sustain this type of damage, their sensitivity to the higher frequencies generally decreases progressively with age. Hearing specialists have discovered that each year after a person reaches about twenty-five, he must sound a high note on the piano with 25 per cent more energy in order to get the same sensation of loudness that he did the year before.

One of the most common causes of deafness in young people is an interference with the conduction from the middle ear as a result of infection or of having the tiny stirrup bone seal tight in the oval window. An individual so afflicted hears better through the bones of his head than through the middle ear.

Tone deafness. People who are unable to tell one note from another are known as *tone deaf*. Ability to differentiate between tones is not, of course, an all-or-none condition. People vary in their sensitiveness to differences in pitch. There is a limit, evidently set by the individual's ear structure, on the pitch discriminations he can learn to make.

In contrast to the two "long-range" senses of sight and hearing, which gather precise information about the environment from long distances, man's other senses are less accurate, operate at much shorter ranges, and con-

sequently are depended upon less extensively. These senses relate to touch, to bodily conditions, to smell, and to taste.

OUR CUTANEOUS SENSES

The sense of touch comprises at least four distinct sensations: pressure, pain, cold, and warmth. Each of these has special receptors and serves the organism in definite ways.

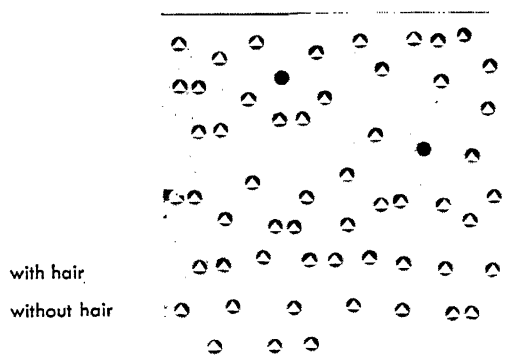
PRESSURE

The sense of pressure is of great use to individuals who do fine manual work of any sort. Engravers at the Bureau of Engraving and Printing use their hands to wipe ink from the printing plates and can feel accurately just how much to wipe off. In fact, their sensitivity to pressure is delicate enough to detect a film of grease only one layer of molecules thick.

All of us use the sense of pressure every day to verify what our eyes tell us. Something may look like wood, but we rub it to make sure it is not plastic. A fabric may look like silk, but the best way to tell is to feel it. The sense of touch gives the blind a partial substitute for their lost vision. They can "read" by means of the Braille system (so named after its inventor, a Frenchman), which uses different patterns of raised dots to indicate all the letters and punctuation used in printing.

The average person is likely to think that

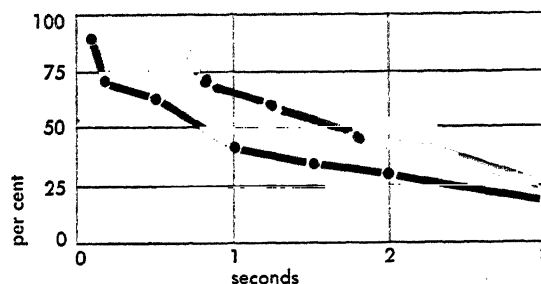
Map of Pressure Spots



In this section of the middle forearm there is close but not perfect relation between pressure spots and the presence of hairs.

Adapted from Boring, Langfeld, and Weld, 1948

Curve Showing Adaptation to Pressure



As can be seen above, considerable adaptation to pressure occurs in a very few seconds. A steady stimulus to any sense organ will evoke less and less response.

Adapted from Woodworth, 1938

every point on the surface of his body is equally sensitive to pressure. In ordinary life we usually encounter pressure from "blunt" objects (such as rings or clothing) which stimulate more than one small area at a time, so that it is difficult to determine just where the pressure-sensitive areas are. Actually, pressure sensitivity exists in tiny spots surrounded by relatively insensitive areas. The richness with which a given portion of skin is endowed with pressure spots determines the sensitivity of that region. The sensitive ball of the thumb, for example, has about 135 pressure-sensitive spots in each square centimeter of its surface; the back of the hand, 30; and the upper arm, 10. The number of pressure-sensitive spots which can be located by systematic application of a stimulus varies with the strength of the stimulus, since some have a high threshold of sensitivity (Guilford and Lovewell, 1936).

The pressure sense is subject to fatigue and adaptation effects. If a gentle pressure is maintained constantly, we soon become unaware of it. For example, after you have been wearing a ring for some minutes, you cannot tell whether you have it on except by looking at your hand or by moving your hand so that the ring stimulates new areas of the skin.

PAIN

Pain spots are located by pressing the skin with a fine-pointed needle. Pain (like pressure, warmth, and cold) shows a point distribution rather than a continuous or even one. Pain spots are much more numerous than pressure-sensitive spots. The number of pain



A hot brass rod is lowered onto the cornea of the subject's eye (above) to test the theory that blood vessels must be present before heat or cold is felt. Although the cornea has many nerves, it has no blood vessels. The subject reported no sensation of heat.

spots per square centimeter of body surface is about 50 on the sole of the foot; 60 on the ball of the thumb; 170 on the eyelid; 230 on the neck. When it is necessary for the physician to draw a few drops of blood, he often pricks the ball of the thumb because that area is relatively insensitive to pain.

The tissues of the inside of the body have few pain spots as compared with the outer surface. Certain internal organs such as the liver, spleen, and kidneys can be cut, crushed, or burned without causing pain. The adaptive significance of this fact is easily seen. Injuries to the skin serve to make the organ-

ism avoid situations in which internal injuries might be encountered. Thus our sensitive outer skin warns us of injury. By the time a wound reaches the inside of the body, on the other hand, it is usually too late for a warning of danger to be useful.

Occasionally a person is born without sensitivity to pain. Such a lack of sensitivity is extremely dangerous; for example, a child will have no warning of injury when he comes into contact with such harmful objects as hot stoves and sharp scissors.

Excessively strong stimulation of *any* sense organ produces pain. The merciless intensity of the light from an electric arc is painful to the eyes if continued for only a few seconds. It is well known that excessively hot or cold objects are painful to the skin. Loud sounds hurt the ear. Certain intense odors are also painful. The reason for this is not that neural impulses from a nonpain receptor can be converted into pain-producing impulses but that receptors for pain are widespread in the body and are found even in the special sense organs.

Each part of the body surface is supplied with pain receptors which come into play only when a stimulus is strong enough to bring about actual tissue injury. The same type of stimulus at lower intensities would not affect these receptors. Usually the pain precedes actual destruction, so that its warning helps us avoid the danger. This is not always so, however, as anyone who has had a bad case of sunburn can testify. Unfortunately, we have no sense organs that are sensitive to the ultraviolet light of the sun.

Pain also occurs in response to any mild stimulus when the body is exceptionally sensitive (a condition known as *hyperalgesia*). Occupations that demand unvarying positions during work often produce neck and arm pains (*cervico-brachialgia*). Finally, pain is sometimes experienced at a location quite distant from the area actually being hurt (*referred pain*).

Some pains are actually considered pleasant. The gratifying reaction to horseradish and hot spices is believed due to activation of pain receptors.

COLD AND WARMTH

Physically, cold and warmth are simply degrees of the same thing—amounts of heat. But psychologically they are entirely different.

When the same area of the skin is mapped for warmth and cold, we see that the two sets of spots do not coincide. This indicates that warmth receptors are separate from cold receptors. The exact physiological structure of these cold and warm spots is not known, although several theories have been advanced.

The number of cold spots varies with the region of the body and the manner in which they are determined. In general, according to the usual method of exploration, there are more cold spots than warm ones on the same area of the body. Experiments indicate that the cornea of the eye is insensitive to heat.

The warmth-sensitive spots are stimulated by the addition of heat, the cold spots by loss of heat. Neither type of receptor is stimulated by objects which are at the same temperature as the skin itself—usually about 90° Fahrenheit. Hence this temperature is known as the *psychological zero point* or the “point of indifference.” The indifference point does not remain constant. To test this, dip your left hand for a few minutes into water at 80 degrees and your right hand into water at 100 degrees. After a short time, your hands will feel neither warmth nor cold. A new psychological zero point has been reached and the receptors are no longer stimulated—*sensory adaptation* has taken place in each hand. Now plunge both hands into water at the usual indifference point of 90 degrees. It will seem warm to the left hand and cool to the right one.

Cold-sensitive spots normally are stimulated by temperatures below the psychological zero point. They give no response at all to temperatures ranging between this point and about 110° Fahrenheit. But, interestingly enough, cold-sensitive spots respond to temperatures *above* 110 degrees with an intense sensation of cold. This is called *paradoxical cold* because the sensation is actually aroused by a warm object. The psychological experience of *heat*, apparently, is not merely one of extreme warmth. Rather, it seems to be a synthetic experience aroused by the simultaneous stimulation of both warm and cold spots. A similar phenomenon of *paradoxical warmth* is obtained when warmth-sensitive spots are stimulated by “cold” objects ranging in temperature from about 75 to 88 degrees—that is, *below* the psychological zero point.

To understand the real stimulus to the sensations of heat, warmth, and cold, suppose you go into a room on a summer day when the thermometer reads 90 degrees. There are sev-

eral objects lying on the table—a water glass, a metal letter opener, a woolen necktie. You hold each one of these objects against your perspiring cheek and observe that the glass and the metal letter opener actually seem cold, whereas the woolen tie feels warm. All these objects are actually at the same temperature, since they are all in the same room; but glass and metal (especially glass) absorb your body heat and so “cool off” your skin, whereas wool prevents body heat from escaping and keeps your skin feeling warm. Thus you see that the effective stimulus to the temperature senses is the *addition* or *subtraction* of heat from the tissue of the receptor cells.

OUR SENSE OF ACTIVE MOVEMENT

It may seem quite a simple thing to stand motionless—but you absolutely cannot do it! In “standing still” a person actually depends on constantly changing activity of his sense organs and muscles. We can demonstrate with the aid of a delicate apparatus that when a person tries to stand still he starts to fall in one direction, unconsciously senses what is happening, and so changes his muscular contractions to correct the falling tendency. Then he starts to fall slightly in another direction; again he adjusts his posture to compensate. This is a continual process made possible by *kinesthetic sensations*.

Close your eyes and relax your body. Have someone place your arm in a certain position and observe that you can report the position of the arm without looking at it. Now let your friend move your arm slowly, bending it at the elbow through a small arc. Notice that even slight bending gives rise to definite sensations of movement, even when your eyes are closed. The receptors which produce these sensations of movement—kinesthetic sensations—are located in the muscles, tendons, and joints of the body. When the parts of the body move, these receptors are stimulated by stretch and pressure, giving rise to kinesthesia. The kinesthetic sense is the most important sense in determining and controlling both body position and movement. It plays a major role in maintaining an erect posture, walking, talking, and many other skilled activities.

Much of what we call "touch" involves muscle sense as well as pressure. The so-called "feeling" of velvet or silk, as contrasted with oil or glass or sandpaper, is composed partly of the muscle sensations produced by different degrees of resistance to the movement of our skin over the surface. Such "feeling" is sometimes called *active touch*.

OUR SENSE

OF PASSIVE MOVEMENT

Imagine yourself lying completely relaxed in some heavy fluid which would support your body in any position without your having to make any conscious effort or muscular contraction. Even though you did not consciously move your body, every time your head changed position you would know it. The receptors involved in giving you a cue to body position under these circumstances are located in the *labyrinth*, or inner ear (page 253). Their function is to keep you informed of your position in space—whether you are moving up or down, right or left, backward or forward. When your body's motion in space is accelerating or decelerating, hair cells in the *ampullae*—swellings at the base of the *semi-circular canals*—are the chief receptors. These hairs are activated by movement of the liquid in the canals; their bending, in turn, stimulates associated nerve fibers. Similar receptors in the *saccul*e and *utricle*, two saclike chambers in the vestibule at the base of the canals, respond to the static force of gravity and to straight-line motion. Both groups of receptors are mechanisms of the inner ear and function best when the head moves. They have practically nothing to do with hearing.

Our sense of passive movement is related to the unpleasant phenomenon of "motion sickness." We know that the inner ear is the organ involved in motion sickness, for people and animals with no vestibular sensitivity do not experience it. For most people, however, the sensation is quite a common one, occurring most frequently in airplanes, ships, autos, streetcars, and trains, in that order.

Effective physiological stimuli for producing motion sickness are: rotation (especially in more than one plane), vertical movements,

head position, certain visual stimuli, physical conditions, and unpleasant odors. Wavelike motions are particularly nauseating when they are of intermediate size and frequency; big or small, or very quick or slow waves are not so likely to make us motion sick.

Perhaps the most outstanding psychological cause of sickness is the experiencing of incongruous sets of sensations. The labyrinthine sense is stimulated only when the body stops or starts in space. On a quiet day an airplane, even when flying close to the earth, gives the passenger no labyrinthine or kinesthetic stimulation. The passenger might just as well be sitting in a comfortable chair at home as far as sense of movement is concerned, and no illness will occur if he either closes his eyes or confines his visual field to the interior of the plane. But if he looks out of the window at the earth rushing past at 300 miles per hour, he may very well get sick, for he is not accustomed to seeing the earth move past him when he has no sense of movement within him. It is this lack of the expected correlation of sensations that may produce illness.

If the plane is bouncing around, on the other hand, it is best for the passenger to close his eyes or look at the earth. If he looks at the interior of the plane, he will feel the sensation of falling without seeing himself falling past something. This is another incongruous sensation and will tend to produce illness. To prevent motion sickness, we must be able to organize our sensations into a meaningful, consistent pattern.

Other psychological factors in motion sickness are suggestion, emotional condition, and conditioning by past experience. Reduction of motion sickness occurs by habituation to the stimuli causing sickness, by lying down, or by taking such drugs as dramamine.

OLFACTION

Although for most of us the sense of smell does little more than add to the enjoyment—or discomfort—of life, among wild animals it is indispensable to survival. Like each of the other senses, it provides a means of contact with the environment. A deer, for example, might avoid a cougar either by seeing it or, at night, by hearing it. But if

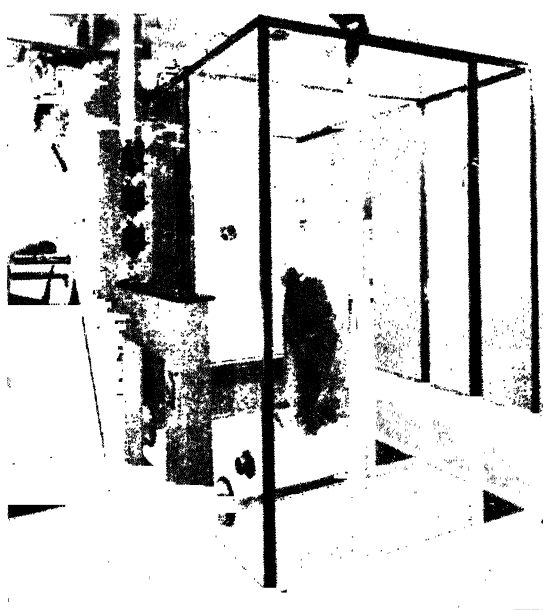
the cougar were lying motionless on a branch overhanging a water hole, the sense of smell would be the only means of detecting it.

Often primitive peoples make greater use of the sense of smell than civilized man, who rarely uses it to its full capacity. The Chukchee tribe of Siberia, for example, make exceedingly fine discriminations between odors and describe many objects in terms of smell which we would describe in terms of appearance or texture. They even go so far as to greet each other by sniffing behind the ear (Odulok, 1934).

The receptors which function in olfactory sensation are located in the upper passages of the nostrils and are stimulated when chemical substances in vaporous form are inhaled. There is considerable confusion regarding the number of fundamental qualities of smell. One traditional system for classifying odors has six classes: spicy, burnt, resinous, flowery, fruity, and putrid. Another system lists only four classes: acid, burnt, fragrant, and caproic (goaty). It is impossible to tell whether any of these qualities has a separate end organ, because the location of the olfactory receptors in the nose makes it impossible to map the sensitive areas as we can those for pain, pressure, warmth, and cold.

Just what happens in our receptors when we smell is not clearly understood. It may be that vaporous substances stimulate the receptors chemically. However, recent studies have indicated that olfaction may be connected rather with a loss of heat from the organism (Beck and Miles, 1947). This theory is based on the knowledge that (1) the entire body is a source of infrared radiation and (2) various gases differ in their absorption of such radiation. It has been proposed that the olfactory receptors radiate a variety of wave-length bands and that different gases, upon entering the nostrils, therefore absorb different bands. The receptors radiating those bands would thus lose energy; and this heat loss might arouse nerve impulses which eventually would be interpreted in the brain as a particular odor. This theory has not as yet been fully evaluated, but several experiments seem to confirm the role of infrared absorption in the perception of odors.

In one experiment with honeybees, chambers containing honey gas were enclosed in wooden boxes placed outdoors in September, when little natural nectar was available. Both boxes contained



At Cornell University this air-conditioned "olfactorium" has been devised for conducting research in the little-understood field of olfactory sensitivity. After being reduced to an "olfactory zero" by scentless baths and mouth rinses, the subject, in airtight clothing, receives various combinations of scents. She then reports her sensations to the experimenter outside.

a window made from a thallium bromide iodine crystal, a substance which permitted the passage of infrared rays. But in one box this window was backed up by plain glass, which is impervious to infrared rays. A constant temperature below that outside was maintained in both boxes.

In order to attract bees to the boxes, plastic tubes containing a little honey were attached in front of each window. When the honey had been consumed, the bees in the tubes were gently shaken out onto the ground below the boxes. One minute later there were ten bees on the window of the experimental box; none were on the glass-backed control window, although three were flying near it. Gradually the bees flew away until only three were on the experimental window and none near the control. During the succeeding fifteen minutes, however, twelve bees lighted on the experimental window and eight others paused before it, whereas none lighted on the control window and only two paused in flight before it. In later experiments in which the plastic tubes were left in place, all the bees collected before the experimental window. When the two tubes were exchanged, the bees migrated back to the experimental window. Appar-

ently they could smell the nectar through the window which permitted infrared rays to pass, whereas they could not through the glass window (Miles and Beck, 1949).

There are great individual differences in the odors people consider pleasant or unpleasant, although in general any odor is unpleasant if it is too intense. Psychological conditioning seems to play a large part in determining whether or not we like a particular odor (McCord and Witheridge, 1949). Indeed, fashions in smell have varied throughout history. In the seventeenth century, for example, people loved the odor of spices and resins and probably would have been as disgusted by our present-day perfumes as we would be by their spices, which only half disguised less pleasant odors that we now take the trouble to obliterate or prevent.

The art of obliterating odors has become a major modern industry. Often unpleasant smells can be washed out with water or absorbed by activated carbon. Much-lauded chlorophyll has been proved ineffective as a deodorizer, but some compounds can neutralize offensive smells by canceling them. For example, cedar wood cancels the smell of rubber.

Fortunately, in many instances, our olfactory receptors become adapted to odors, so that even the foulest stench or the most permeating aroma soon becomes less noticeable. Another interesting phenomenon is that when we are concentrating on other matters, we often are unconscious of odors. Sheer imagination also can affect our sense of smell, as shown in a recent study conducted on three hundred college girls.

Samples of two popular brands of perfume and toilet water were used, as well as distilled water for a control. Samples were presented to the subjects on blotting paper or in a special instrument known as an olfactometer. Each girl was asked to sniff two samples; state whether the two scents were the same or different; and, if different, decide which she preferred. Actually the two samples were identical in every case.

Among the subjects who were given identical samples of Evening in Paris perfume to smell, 38 per cent decided that the two samples were different; 17 per cent of those who smelled only distilled water found a difference in the samples. Although most of those who expressed a preference for one of the two samples preferred one only slightly more than the other, as many as 13 per

cent claimed to prefer one sample "very much" (Eisenson, Fisichelli, and Welch, 1954).

In view of the fact that so many millions of dollars are spent each year for perfumes, it is surprising how little scientific work has been done to discover the factors determining preference for scents.

OUR SENSE OF TASTE

The receptor cells of the sense of taste are activated through some sort of chemical stimulation by the material tasted. These receptors are called taste buds and are located in clusters. The newborn baby has his full quota of them—about 245 per cluster. As the individual passes middle age, however, there is a marked tendency for the number of sensitive taste buds to decline. Old people who complain that their meals taste flat are not merely hard to please; they are simply unable to taste as well as they once could (Arey, Tremaine, and Monzingo, 1935). In some very old people, no taste buds whatever are found.

Smoking reduces taste sensitivity temporarily (Sinnott and Rauth, 1937). For this reason gourmet clubs will not permit smoking during their dinners.

There are four elemental qualities of taste—sweet, sour, bitter, and salt. Sour-sensitive spots are located mainly along the sides of the tongue; sweet-sensitive spots along the tip; bitter-sensitive spots at the base; and salt-sensitive spots on the tip and sides.

When the same substance activates two different sets of receptors, each gives rise to its own characteristic sensation. Saccharine is sweet when tasted on the tip of the tongue and bitter when tasted at the base.

The taste buds are apparently activated by extreme cold as well as by chemical stimulation. This was testified by Charles Horvath in a description of his experiences on a scientific expedition near the North Pole (*Los Angeles Times*, April 5, 1956). He stated that if he opened his mouth when it was 60° below zero he could literally *taste* the "bitter cold." He likened the sensation to having a

rag that had been soaked in alum stuffed down his throat.

What we call "taste" in food is influenced by its smell, by sensations of warmth and cold, by cutaneous and kinesthetic impressions, and in some cases by mild pain. Smell is particularly important in determining flavors. Scientists studying the flavor of the tomato in order to determine how best to preserve this taste in tomato paste analyzed the odors involved and found that they ranged from "sweet, flowery, and minty" to "rubbery" and "slightly musty." Specific odors analyzed from the tomato included those of rose, violet, lemon, peppermint, caramel, vanilla, sulfur, and citronella (Spencer and Stanley, 1954).

In taste, as in vision, we have *contrast effects*. The lemonade tastes sour if we eat cake first. Likewise, we have *complementary tastes*, a mixture of which tends to neutralize both. Thus sugar takes the sourness out of lemon. Sweet and bitter also tend to neutralize each other. Bitter and sour are complementary to a lesser extent, as are salt and sweet.

S U M M A R Y

In order for a sensory response to occur, a *stimulus* must activate *receptor cells*, from which nerve impulses travel through the *nervous system* to the *effectors* or organs of response. Only stimuli which are above the *threshold* can activate the various receptors. We do not always respond even to adequate stimuli, however, for much incoming nervous activity is *inhibited* within the central nervous system. The senses are also subject to effects of *adaptation*.

Among all the human senses, vision is one of the most important. Light rays from an object enter the eye through the *pupil* and are focused by the *lens* onto the *retina*, which contains the visual receptor cells. From these, nerve impulses travel via the *optic nerve* to the *occipital* area of the brain. The two kinds of visual receptors are the *cones*, which produce sensations both of hue and of brightness, and the *rods*, which produce sensations of brightness only. Images are clearest when visual stimuli strike the *fovea*, in which the cones are densest and in which no rods are present. During the process of *darkness*

adaptation, color discrimination disappears and the rods take over the task of seeing.

The eyes make many kinds of movements, including *convergence*; *accommodation* of the lenses; *contraction* of the pupils; *cyclofusional* movements; *jump* movements when looking at motionless objects; and *pursuit* movements when following moving objects.

The three qualities of color are *hue*, determined by the frequency of light waves; *saturation*, determined by their complexity; and *brightness*, determined by their amplitude. The relationships among these qualities are clearly shown in the *color solid* and the cross-sectional *color wheel*. Any two hues opposite each other on the wheel combine to produce gray and are called *complementary colors*. Any other two hues fuse to produce intermediate hues or blends. In combining colors we must distinguish between the *additive* mixture of lights and the *subtractive* mixture of pigments.

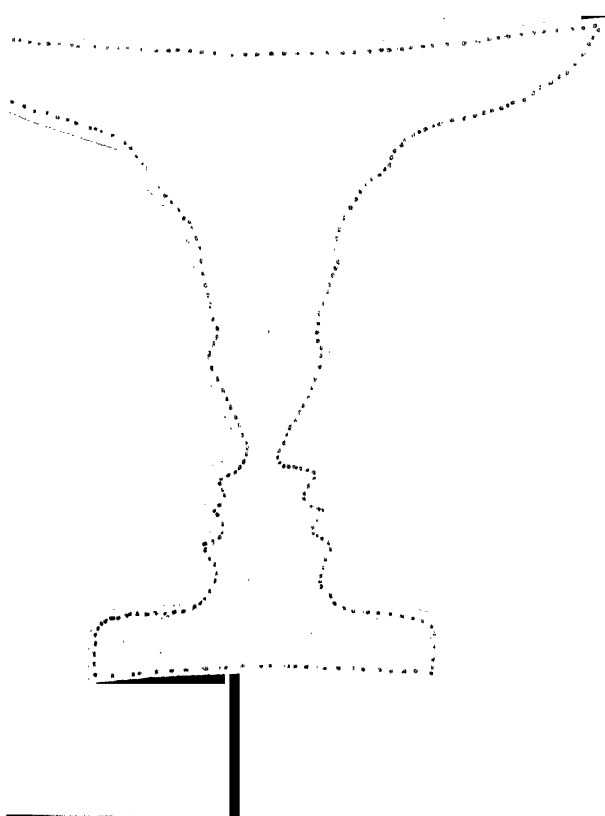
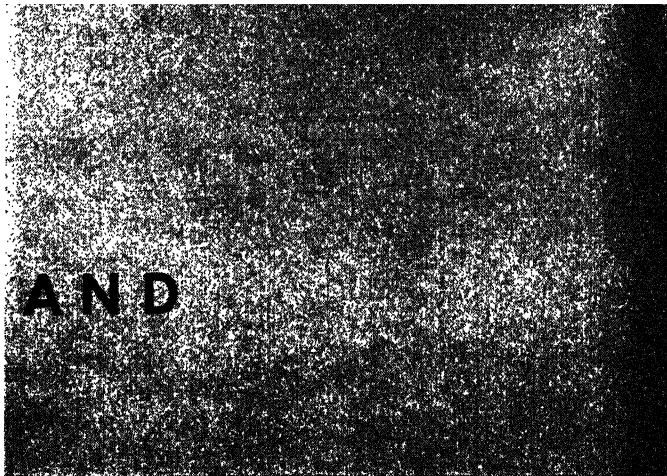
Like color, sound has three dimensions: *pitch*, determined by the frequency of the sound waves; *loudness*, determined by their intensity, and *timbre*, determined by their complexity. When sound waves strike the ear, they cause the *eardrum* to vibrate. It in turn transmits the motion to the *hammer*, *anvil*, and *stirrup* bones, whose movements cause a vibration of the *oval window*, a membrane between the middle and inner ear. The window's vibrations cause movement in the fluid of the *cochlear canals*, exciting hair cells on the *Organ of Corti*—a thickening of the *basilar membrane*. Nerve impulses stimulated by the hair movement travel through the *auditory nerve* to the brain. The most satisfactory theory of hearing incorporates both the *place* principle and the *volley* principle.

Another important group of senses are the cutaneous senses, which include *pressure*, *pain*, *warmth*, and *cold*. All these senses show a point distribution rather than a continuous one. Our kinesthetic sensations give us our sense of *active movement*. In the labyrinth, or the inner ear, are found the receptors for our sense of *passive movement* or body position.

Little is known about olfaction, although recent evidence indicates that it may be related to infrared radiations of the olfactory receptors. Our *sense of taste* consists of four elemental qualities—sweet, sour, salt, and bitter. Taste is complicated, however, by smell, and other sensory impressions.

CHAPTER TEN

ATTENTION AND PERCEPTION



PERCEPTION DEFINED

ATTENTION AS PREPARATION
FOR PERCEPTION

FACTORS DETERMINING WHAT
WE PERCEIVE

SPACE PERCEPTION

TIME PERCEPTION

EXTRASENSORY PERCEPTION

ACCURACY AND SPEED OF PERCEPTION

Our world is composed of a near infinity of objects, all giving off stimuli capable of producing sensations of some kind—pressure, color, sound, smell, or others. The senses do *not*, however, directly identify objects or tell us of the relationships among them. The process by which we know these things is called *perception*. Through our perceptual processes we gain the kinds of information about our environment that we need for effective adjustment.

Perception is a very personal thing. As we shall see in this chapter, a person's perception of a situation is often influenced as much by the needs he brings to the objective situation as by the stimuli he receives.

PERCEPTION DEFINED

The process of perception stands midway along a continuum from sensing to thinking. In its purest, perhaps hypothetical form, sensing does not involve the use of learning based on past experience. Thinking, at the other end of the continuum, is independent of stimuli from physically present objects; it is accomplished through the use of symbols which represent absent objects and the relationships among them. *Perception* uses *both* the sensations aroused by stimuli and the learning gained from past experience.

Perception enables the individual to know where he stands in relation to the objects and conditions and people in his environment and to act accordingly. Part of perception, of course, consists in determining the relationships between one object and another—but even this is done ultimately in reference to oneself. Terms such as *right*, *left*, *above*, and *below*, for example, are obviously based on the individual's own position as a point of reference.

In order for us to perceive an object, it is not necessary for all parts of it to stimulate our sense organs directly. When you look at a chair, for example, you cannot see all sides of it and perhaps cannot even see one of the legs; yet you see the chair as being *solid* and *whole*. Thus perception is a process of "filling in."

An individual's ability to perceive a series of fragments as the whole object depends upon many factors. The intelligence of the perceiving individual and his mental set—that is, what he *expects* to see—are extremely important. So is past experience. Look at the pictures on page 266. What are they? If you are not sure, turn to the footnote on page 268, where they are identified. Then look at the pictures again and you will have no difficulty in "seeing" what they represent. As a rule, the more intelligent a person is the fewer details he needs to perceive a whole.

Our reaction to any situation is determined by the way we perceive it—not merely by the



objective facts of the situation. It is quite possible that the same physical stimulus will be perceived in two quite different ways by two different people or even by the same person at two different times. On your "good days," for example, college and everything about it may seem very satisfying; but on "blue Monday" your classes may seem dull, the food at the dormitory tasteless, and your friends irritating.

Perception carries the conviction that what we see is a true representation of reality. Hence the old saying, "Seeing is believing." An *illusion*, or false perception, seems false only when we compare it with what we know to be true. To the uninitiated, a stick seen partly through water and partly through air does not just *seem* bent—it *is* bent.

high, others too low for the human ear to detect; some pressures are too light to be felt; the human eye cannot see above the violet or below the red of the spectrum. Many physical energies, in other words, are below the threshold for each sense organ. Other stimuli are too nearly alike for the sense organs to discriminate. The *physiological sensitivity* of the human organism, then, sets one basic limit on what we perceive.

An equally important factor is that of *psychological selectivity*. From among the many stimuli which are within range physiologically, we select—and consciously react to—only those that are related to our present needs and interests. For example, when we are deeply involved in an interesting conversation, we usually are not much aware of the temperature and furnishings of the room or the noises of traffic outside. This process of psychological selectivity is called *attention*.

Attention is preparatory to perception. When we listen to an interesting person talk, we perceive most clearly the words and ideas he is expressing, because these have the *focus* of our attention. We are only vaguely aware of his manner of speaking, his posture, and his dress. These things are on the *periphery* of attention, and although as physical stimuli they may be just as intense as the stimuli of the speaker's words, our perception of them is much less accurate and complete. If, however, the speaker should "call our attention"

ATTENTION

AS PREPARATION

FOR PERCEPTION

Of all the physical energies in the world about us, we perceive relatively few. Some are "tuned out" by the sense organs themselves, which are stimulated only by energies of certain intensities. Some sounds are too

to the new suit he is wearing, our focus of attention would shift, and we would clearly perceive the suit which previously was unnoticed. The selective nature of attention, then, is obviously a basic factor in perception.

ASPECTS OF ATTENTION

We may regard attention as having three interrelated aspects, all of which are part of a single complex act. Attention is (1) an adjustment of the body and its sense organs; (2) clearness and vividness in consciousness; and (3) a set toward action.

Attention as a postural response. When we attend to something, we adjust the body and its sense organs to receive particular stimuli most readily. When the physician listens with his stethoscope for certain faint sounds in the chest of his patient, his postural adjustment is as complete as is humanly possible. He may even close his eyes to shut out distracting visual stimulation. This is a familiar example of the way we select the significant stimuli from among the many to which our sense organs *could* respond.

There is also a more general postural adjustment in attention. It is the last of the ninth inning; the score stands 2 to 0 in favor of the team in the field, with the bases full. Look at the shortstop. His posture defines attention better than words ever could. He stands alert, eyes darting from runner to runner, his body ready for instant and coordinate reaction.

Attention as clearness in consciousness. We must rely on the method of introspection to illustrate our second definition of attention. Do you wear glasses? If so, were you noticing the rims just now? Probably not. Yet they are in your field of vision. Look for them and there they are. Is a clock ticking in the room where you are studying or a radio playing softly in the distance? If so, were the sounds vivid in your consciousness a few seconds ago? Probably not. This change in the vividness of our perception, even when there is no corresponding change in its physical intensity, is an example of attention as clearness in consciousness.

Attention as a set toward action. Attention may also be regarded as a *set*, or *readiness to respond* in a particular way to some stimulus situation for which there are a variety of possible responses. For example, when the squad leader says "MARCH" (command of ex-



Can you see any figure in the pattern above? There is a cow hidden in this picture; if you have difficulty finding it, look on page 269.

ecution), the response of each of his men will depend upon what *set* has been established by the prior "command of preparation," such as "FORWARD." In this sense, set is a motivating condition. As we shall see later in this chapter (page 293), set is also an important variable in determining speed of reaction.

Set determines thresholds of effective stimulation. A few minutes ago you found that you had not been responding to many of the stimuli around you—the clock, the radio, and so on—because you were set to respond to other stimuli. If time were of utmost importance in a situation, however, not only would you probably notice the ticking of the clock, but it might actually become *subjectively* louder and seem to dominate your whole perceptual field.

THE DIRECTION OF ATTENTION

What are the factors that make an object or situation attract our attention? This is a question of enormous practical importance. In advertising or selling, to take but one example, the attention of the prospective buyer must be attracted before he can be sold on the product. In education, too, one of the first tasks of the teacher is to win his students' attention, in the broadest sense of that word.

Conditions of attending. There are three kinds or conditions of attentive adjustment: involuntary, voluntary, and habitual. Each has a somewhat different "history."

Involuntary attention. Certain stimuli seem to have a natural power to attract the attention. You are concentrating on your psychology assignment when suddenly a loud noise outside the window draws your attention. The

characteristic thing about involuntary attention is that it is accompanied by no consciousness of effort. In fact, when some prepotent stimulus such as the sudden loud noise is presented, it is difficult for you to pay attention to anything else.

Voluntary attention. Voluntary attention is forced by the individual's motivation to accomplish or experience certain things. Self-observation during voluntary attention reveals a mass of strain sensations which, taken together, are called *effort*. Introspection also reveals some element of conflict. Even if the individual sticks to his task, other stimuli constantly vie for his attention. Prolonged voluntary attention ultimately results in fatigue or boredom.

Habitual attention. Habitual attention, like involuntary attention, involves no conscious effort or conflict. The important difference between these two forms of attention is in their histories. We arrive at habitual attention only through practice.

Teachers, public lecturers, industrial trainers, and writers of textbooks try to arrange their materials in a way that will appeal to the involuntary attention of the audience and to already established interests. A liberal dash of attention-getting stimuli will serve as sauce to make the "drier" but equally important parts more palatable.

One of education's greatest functions is to foster interests in varied areas. Once this has been done, further learning becomes far easier. But there is no easy road to effortless, habitual attention. Everyone must go through the effortful stage of voluntary attention first.

The influence of specific factors. In addition to the general conditions we have already discussed, many specific factors influence the direction of our attention in a given situation. Some of these, like change and size, are characteristics of the stimulus situation; others, like organic conditions and personal interests, are factors that depend on the individual. It should be remembered that several of these factors usually operate together in determining the direction of our attention and that the effects of one may wholly or partially cancel out the attention-getting value of another.

Change. Change usually attracts attention. Change is movement in any direction: from one place to another; from one intensity to another; from absent to present; from red to green; from high to low; from moving to stationary. The young kitten ignores the ball of yarn when it is still but pounces on it when it moves. A sudden shout in the middle of a quiet talk or a whisper from a man who has been shouting makes you "sit up and take notice."

Size. Other things being equal, a large advertisement attracts attention better than a small one. A recent report showed that advertisers have been making more and more use of the full-page advertisement to attract the reader's attention.

Issues of *Time* and *Newsweek* for two periods of five years each were studied: the prewar years of 1936 to 1940 and the postwar years of 1945 to 1949. Both of these magazines showed a significant increase in the use of full-page advertisements during the postwar as compared to the prewar period. In the case of *Time*, the increase was from 40.8 per cent to 59.2 per cent of total advertising space; for *Newsweek*, the corresponding figures were 53.6 per cent and 61.3 per cent (Trenchard and Crissy, 1951).

Size, however, is not the only factor favoring the full-page advertisement. Another is its isolation from materials which would compete for interest. A half-page advertisement might suffer by its nearness to another advertisement—perhaps even a smaller one—which appealed more to the reader's interests and needs or which had a more striking layout. Size, in other words, is only one of many interrelated factors determining the direction of our attention.

Prepotency. Some stimuli are more potent in attracting attention than others. For example, high sounds are prepotent over low sounds; tickling and itching over broad, smooth pressure; and saturated colors over pastel shades. The effectiveness of such prepotent stimuli does not necessarily depend on the relative strength of competing stimuli nor does it depend upon previous experience or training.

Repetition. A weak stimulus frequently repeated may be as effective as a strong one presented once. But there is a limit to the

*The pictures on page 266 are: left, cigarette ends; right, a piece of steak.

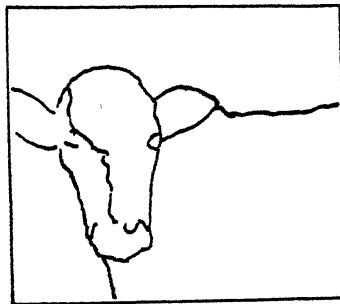
effectiveness of repetition. If overdone, it can lead to monotony.

Experience shows that repeating a fundamental theme or motif with minor variations is more effective than repeating it exactly. An effective advertising or political campaign or a public welfare educational program repeats an essential idea with numerous small variations. Music and architecture offer many examples of how attention can be maintained by repetition of a central theme with variations.

✓ *Organic conditions* The characteristics of the stimulus object itself are sometimes less important than the subjective factors in attention. For example, the stimulus that wins the race for your attention is usually the one that relates to the strongest biological need operating at the moment. If you are hungry, stimuli related to food will be the ones to attract your attention. If you are tired, stimuli related to resting will be most effective.

Interests. People vary greatly in their responses to the same stimulation because a person's interests, like his organic condition, predispose him toward or away from a particular response. Let us suppose that a geologist, a farmer, an artist, and a real estate promoter are looking at the same plot of ground. The geologist's attention might be attracted to the layers of rock exposed where the road cut through a hillside. The farmer would probably examine the soil and any plants or weeds growing in it. The artist might walk about until he found a position from which the landscape was a balanced composition that could be painted. The real estate promoter might look the property over carefully to see how it could be subdivided. The objective stimulus would be the same for all these individuals, but because their interests differed, their attention and behavior would vary accordingly.

Social suggestion. In general, people attend to what is pointed out to them. Probably this is because they have enjoyed many satisfactions and avoided many discomforts or injuries in the past by acting on the suggestions of others. Herein lies the basic explanation of the effectiveness of the following old prank. When you are in a crowd, start looking intently toward the sky. Move your head slowly, letting your eyes sweep through a wide arc as though you were following some moving object. Before long, many of the people about



The hidden cow in the picture on page 267 is outlined above. Now that you know where to look for it, turn back to page 267 and see how easily you can detect it.

you will do the same thing. They are reacting to the suggestion that is implicit in your actions. Most people will shift their attention at least momentarily when someone suggests, either directly or implicitly, that they do so.

THE SHIFTING OF ATTENTION

Notice the eyes of a person who is looking at a picture. You will see that they dart here and there, pausing but a short time in any one position. This is typical attentive exploration. The individual's attentive adjustment is not stable and fixed but shifts constantly from one aspect of a situation to another.

Our attention also fluctuates involuntarily, although this phenomenon is not as readily noticed. Hold a watch far enough from your ear so that you can barely hear it tick. Now listen to the ticking, and you will observe that it seems to grow louder, then fades to a point at which it cannot be heard, then grows again, and so on. The period of these fluctuations varies from between a fraction of a second to several seconds depending on the individual and the exact conditions of the experiment.

As another simple experiment with this phenomenon, fix your gaze on a faint gray smudge on a blank sheet of white paper. You will observe the same oscillation of the subjective strength of the sensation aroused.

These experiments demonstrate the important fact that adjustment of the sense organs and attentive adjustment are not entirely the same. It is possible to fix the eyes on an object and maintain that fixation and yet have fluctuations of attention. You undoubtedly have

had the experience of staring at, without seeing, an object you have been looking for.

DISTRACTION

When we are distracted, our attention shifts involuntarily. It is almost impossible to ignore completely certain distracting stimuli such as pain, bright lights, and loud sounds; others do not bother us as much. For example, we can become accustomed to a distracting odor in a relatively short time.

When the distracting stimulus strives to attract the sense organ that is already involved in attention, it tends to "mask" the weaker stimulus and thus seriously interferes with attention. For example, noises would interfere greatly with one's telephone conversation; flashing lights probably would not.

The most obvious effect of distraction is reduction in efficiency.

One study measured the cost of distraction in terms of energy required per unit of work. Typists worked on some days surrounded by soundproof partitions and on other days with the partitions removed so that the usual office noises prevailed. Energy cost was measured by having the girls exhale into a bag specially constructed to capture the expired air, which was then analyzed to determine the amount of carbon dioxide. From this the consumption of oxygen was computed. The amount of typing accomplished was the same under the two conditions, but the energy cost of the typing done under noisy conditions was decidedly greater (Laird, 1928). These results were confirmed by a similar experiment (Freeman, 1939).

Another study indicates that the energy cost of work performed under noisy conditions is greatest immediately after the shift from quiet to noisy surroundings. Apparently a person can become accustomed to noise that is not actually painful (Harmon, 1933).

The effect of noise upon the performance of routine tasks depends partly on the individual's "set" or expectation.

Four groups of fifteen subjects each performed simple addition tasks under conditions of quiet and noise for thirty minutes a day over an eight-day period. Their performance on the first day was used as a basis of comparison with the scores made on succeeding days. After the first day each of the four groups was given a "set." Group A was simply told

that the experiment dealt with the effects of noise on work. Group B was shown a faked work graph indicating that in previous experiments subjects had worked better under noisy conditions than under quiet. Group C was shown a faked graph which led them to believe that previous subjects had done better under quiet conditions. Group D saw a false graph indicating that previous subjects had at first performed better under quiet conditions but had gradually become accustomed to the noise until they were working better under noisy conditions.

Results indicated that Group B subjects produced a significantly higher response rate under noisy conditions than did the other groups, whereas Group C had a somewhat higher rate under quiet. Members of Group D gradually increased their response rate under noise, as the faked graph had suggested they should. Group A, who had been given no particular set, did about as well under noise as under quiet, gradually improving their performance under both conditions during the experiment (Mech, 1953).

In this experimental situation an internal factor was operating in addition to the external factor of noise. Many distractions are internal ones of this sort. Worries and fears can intrude to distract us from the work at hand. Research has shown that people who are bothered by many personal problems tend to have more accidents than others.

Another personal factor, ability to organize a perceptual field appropriately, affects performance under distraction.

In this study perceptual organization was measured by the Rorschach inkblot technique. In many of the Rorschach blots there are discrepancies, usually between form and color, which make it difficult for the individual being tested to perceive an organized whole. For instance, a subject may say, "That would make a perfect bear—but it can't be—it's red." Ability to organize only the relevant stimuli and to disregard the irrelevant ones varies greatly among individuals. To test the hypothesis that persons who can readily organize the perceptual field will be able to perform better under distracting conditions than will those who cannot, the investigator first gave the Rorschach to thirty-five male volunteer subjects. Later the same subjects were asked to perform a simple motor task and were subjected to a variety of distractions. As predicted, those subjects who scored higher on the Rorschach Index of Perceptual Maturity performed better under distraction than did those who made low scores on the Index (Lofchie, 1955).

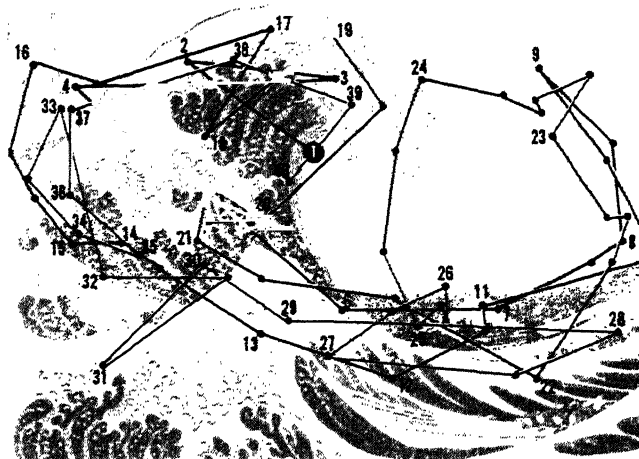
Physical distractions can often be reduced, but the control of distraction is largely an individual matter. Inattention usually stems from lack of interest. Explore your own motives and find out why the distracting thing draws your attention from the business at hand. This may suggest the cure. If you are studying, remind yourself of the importance of what you are doing. Try to relate what you are studying to everyday problems. And remember that the longer you stay with a subject the easier it will become.

FACTORS DETERMINING WHAT WE PERCEIVE

After many years of research, psychologists still know very little about what actually is involved in perception. By what process, for example, do we organize isolated stimuli so that we perceive definite objects rather than unrelated lines, points, and bits of color? Why do we "see" a whole object even though we receive stimulus energy from only part of it? How much of perception can be explained by the organization of our brain and nervous system and how much is the product of learning?

Although psychologists have barely begun to find answers to these and other questions about the "why's" of perception, they *have* discovered a great deal about the "ways" of perception—that is, about the general laws under which it seems to operate. They know that perceiving involves a great deal more than merely the functioning of our receptors, important though that is. In the perception of a single object at least three kinds of processes are usually involved: receptor processes, symbolic processes, and affective processes. Let us take a simple example.

In walking through a neighbor's garden, you may perceive a beautiful rose. As you look at it, bend to smell its fragrance, and perhaps feel the delicate texture of its petals, a number of *receptor processes* are brought into operation. At the same time, through *symbolic processes* the rose brings to mind former occasions when you have seen similar roses in other gardens. It may remind you of some person whose favorite flower is the rose. Or it may bring to mind an occasion when you



The eye movements a subject makes while looking at a picture or reading an article can be recorded by a camera developed by the late Dr. Herman F. Brandt. The movements are then plotted on transparent paper which is laid over the picture or article, showing at a glance the course traversed by the subject's eyes and the order of his fixations. The shifts in fixation in viewing paintings have been carefully studied by Buswell; a typical record of how the eyes behave is shown at top (Buswell, 1935). Each dot represents a fixation; the numbers are provided merely to aid the viewer in following the order. This eye-movement camera also has commercial uses. As one means of deciding between two alternate package designs, for example, the Container Corporation uses the camera below to see whether significant copy and illustrations are really seen by the consumer.



presented a bouquet of roses to someone. All these memories and images are examples of the symbolic processes active in perception. In addition, certain *affective processes* operate to make your perception of the rose seem pleasant or unpleasant. In most cases perceiving a rose, with its pleasing color and scent and its association with happy events, is a pleasant experience. However, if you happen to be allergic to rose pollen or have recently attended a funeral where there were a great many flowers, the rose may affect you unpleasantly instead.

Interwoven with all these processes and in a sense underlying them are your basic classifications of experience, gradually acquired since early infancy. Everyone possesses "persistent, deep-rooted, and well-organized classifications of ways of perceiving, thinking, and behaving" (Vernon, 1955). These classifications are known as *schemata*. They involve the classification of situations of related kinds and also the classification of kinds of behavior appropriate in these situations. Thus your schemata of gardens and flowers would lead you to expect to see roses in a garden at a particular season of the year. These schemata would also enable you to recognize unfamiliar flowers as flowers and cause you to engage in such appropriate behavior as bending over to sniff them. Or you might pull a weed, a plant which is inappropriate in the garden. It is important to remember that the schemata are flexible and subject to constant change with further experience. For instance, if your neighbor exclaims, "Don't pull that! It's not a weed; it's a rare plant I just bought this spring," you rapidly revise your schemata.

Just how the schemata are formed and just how the various processes interact so that we experience integrated perceptions is not completely understood. However, certain factors which aid in the organization of perception have been discovered. We have already examined the various factors which influence the direction of our attention and thus, in a sense, prepare us for perception. Similarly, when we attend to a particular stimulus situation, certain factors operate to make us organize that experience—or perceive it—in a particular way. Some of these factors may be thought of as characteristics of the stimulus object itself, whereas others are more closely related to the physical and psychological condition of the individual.

CHARACTERISTICS OF THE STIMULUS OBJECT

Factors which are mainly characteristic of a stimulus object or situation in the external environment are: nearness, likeness, and inclusiveness of the parts and the part-whole relationship.

Nearness. The physical nearness, or *proximity*, of elements to each other makes for their perception as parts of a pattern. Look at the row of dots below. Do you see just ten individual dots, or four groups of dots, or some other number of groups?

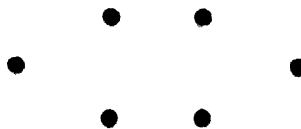


Likeness. Similar elements tend to be perceived as belonging together. This again illustrates the organizing tendencies of perception. Look at the figures below.



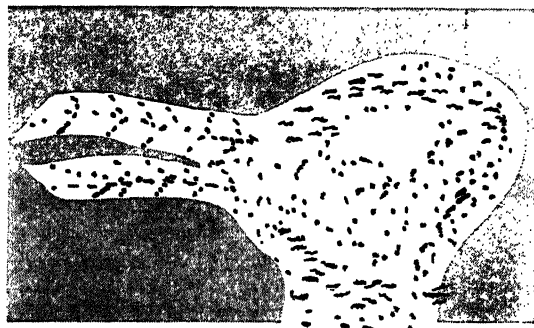
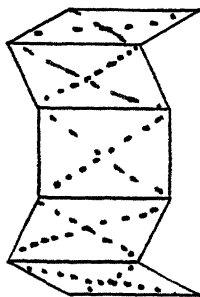
You will notice that they seem to organize themselves into three groups based on the similarity of the figures. You tend to see squares made up of four X's and four circles; you do not see squares made up of two circles and two X's.

Inclusiveness. The pattern which "uses up" all the elements will be more readily perceived than other possibilities. In the figure below you see a hexagonal object formed by all the dots, rather than a square formed by the four middle dots with two single dots at either end.



Part-whole relationships. Parts of a situation are perceived as belonging to a whole, and the manner in which the whole is perceived will influence the meaning of the parts. This is another way of saying that what we see de-

depends upon surrounding conditions, or *context*. In the first drawing below, the end sections and the center rectangle may appear to project toward you or away from you. The other figure may be seen as either a duck or a rabbit. The meaning of the lines depends upon the whole to which they belong.



The organization of the visually perceived whole often takes the form of *figure* and *ground*. The figure is the part of the pattern that is most clearly perceived at a given moment, while the rest of the perceptual field becomes ground. When we look at a person or at a piece of furniture in a room, for example, that particular object seems to stand out—or be separate from—the background of the room. Similarly, the words on this page stand out as figures on a white ground. The figure always seems nearer to the observer than does the ground against which it appears. A reversible figure and ground is shown on page 264.

The importance of context, or part-whole relationships, is clearly illustrated by our perception of color. We may have trouble identifying the colors of an object unless we know something about the nature of the surrounding illumination. Ordinarily we are never in

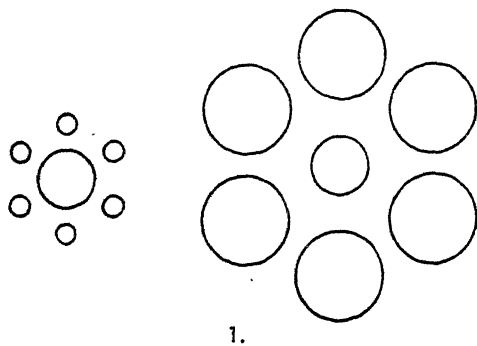
doubt about this. We know whether a day is cloudy or bright, whether a room is dimly or brightly lighted, whether an object is shadowed or not. In perceiving color we automatically "correct" our sensory images according to what we know about the conditions of illumination. Suppose, however, that you look into a specially prepared chamber which contains a disk of dark gray paper, strongly illuminated from a hidden source, and other objects of lighter shade not so strongly illuminated. Under these circumstances the darker disk will appear to be lighter.

In general, if the observer sees the light reflected from an object as brighter than the surroundings, the object is seen as white; if the light reflected from the object is seen as bluer than the surroundings, the object is seen as blue. If a piece of gray paper is illuminated by blue light, the subject who is unaware that the illumination is blue will report the gray paper as blue. In other words, each element is automatically interpreted in terms of the total situation, as perceived. Just how this process goes on in our nervous system is still a mystery.

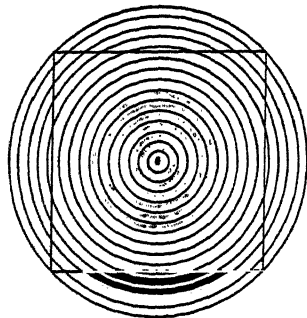
The effect of our surroundings even influences our perceptions of other people, as was indicated by a recent experiment.

The subjects, ignorant of the real nature of the experiment, were told that the study dealt with the stereotyping of faces. They were given ten phototyping of faces and asked to rate them, using a six-point scale, as to the "energy" and "well-being" shown in each face. Each subject did his rating in one of three rooms: a "beautiful room," attractively furnished and provided with draperies and paintings; a "neutral room," furnished like a neat office; or an "ugly room," resembling an untidy janitor's storeroom. Each subject was first left alone in the room for two minutes so that he could absorb its atmosphere before beginning the task. Those who rated the photographs in the beautiful room gave significantly higher ratings on both well-being and energy than did those in the ugly room. The ratings from the average-room subjects fell between those of the other two groups.

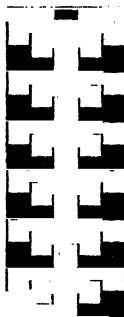
In order that the long-term effects of surroundings could be observed, the two examiners who had presented the photographs to the subjects were themselves used as unwitting subjects. Each examiner spent six sessions (one session per day for six days) testing a total of thirty-two subjects. The length of the session varied between one and two hours. Each



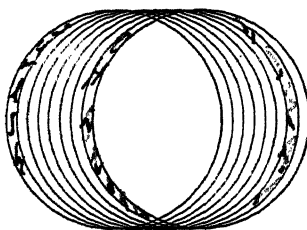
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2.



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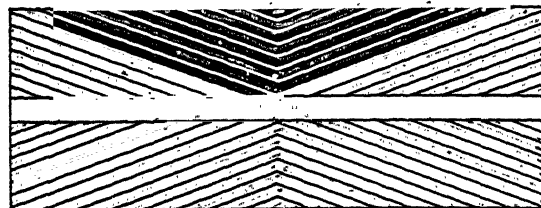
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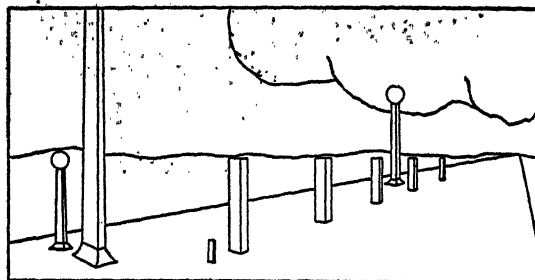
7.



8.

IMAGES

9.



10.

What we see is seldom simply a point for point representation of the stimulus pattern. How we see sizes, shapes, depth, proportions, and even colors depends on the whole stimulus pattern and on our past experience. Most "illusions" are only striking demonstrations of the organizing which goes on in our nervous system in all perception. Some sample illusions are shown above.

1. The center circles are the same size, but their surroundings make you perceive them as different.
2. This is a perfect square. Measure it.
3. The striped bars are parallel to each other.
4. Keep staring at this coil, and you will see through it from first one direction and then the other.
5. Are the inside curves identical?
6. Although the bars are all pure white, we tend to

see gray at each intersection except the one on which we are focusing.

7. Which of the diagonal lines at right is a continuation of the line at left?

8. Are the horizontal lines parallel?

9. The single, unconnected lines give the illusion of solid block letters.

10. The distant lamp post and the one in the foreground are exactly the same size, as are the first and last fence posts.

Figures 1, 6, 7, and 10 are by the courtesy of C. H. Stoelting Co., Chicago. The other figures are illustrations by Fred H. Lyon, in *Experiments in Optical Illusions*, by Nelson F. Beeler and Franklyn M. Branley. Copyright 1951 by Thomas Y. Crowell Company, publishers.

examiner spent an entire session in one room and then changed to an alternate room for the next day's session. At the end of each session the examiners took the photograph test themselves. Like the other subjects, they found more energy and well-being in the faces when they had been working in the beautiful room. Furthermore, the examiners finished their testing more quickly in the ugly room and had such reactions as monotony, fatigue, headache, irritability, and hostility. After a session in the beautiful room, one commented, "I was really beginning to feel like a wheel in here, sitting in a swivel chair and making like a psychologist. It's a lot of fun." He spoke of the other room as the "dungeon." The other examiner indicated her negative feelings about the ugly room by inadvertently leading a subject into the rest room across the hall at the beginning of one session (Maslow and Mintz, 1956).

We have all had similar experiences in everyday life of feeling depressed, irritable, and overly critical when our immediate surroundings—or even the weather conditions—are unpleasant.

CHARACTERISTICS OF THE PERCEIVER

The way we perceive various things in our field of experience depends not only upon the external characteristics of the stimulus object but also upon such individual factors as our past experiences, organic and psychological needs, and personal and social adjustment. In general we tend to see what we *expect* to see and what we would *like* to see.

Perception has two important functions in enabling the individual to cope effectively with life. First, perception maintains the stability of the environment, integrating the contributions of the various sense organs into a harmonious whole. Secondly, it clarifies and defines ambiguous stimuli (Hilgard, 1951). A good example of the clarification of an ambiguous stimulus is seen in the following experiment.

The subjects' task was to match the color of a stimulus patch to one of the colors on a variable color-mixer. In one phase of the experiment the stimuli were pieces of gray paper cut in the shape of a tangerine, a lemon, a neutral oval, a boiled lobster claw, a carrot, a banana, and a neutral elongated ellipse. Each was mounted on blue-green paper and covered with a piece of finely ground

glass. Through simultaneous hue contrast (page 248), the gray patches appeared brownish orange in color. The color-mixer could be shifted from well-saturated red through the oranges to well-saturated yellow. Starting once from the red position and once from the yellow, the subject was to stop the wheel at the point he thought most nearly coincided with the color of the stimulus-patch. As each object appeared, he was told, "This is a tangerine" (or a lemon, or a carrot, etc.). The normally red object (lobster claw) was judged considerably redder and the normally yellow objects considerably more yellow than normal. Although some subjects said that they believed all their matches to be the same, their settings ranged from a yellowish orange to a reddish orange (Bruner, Postman, and Rodrigues, 1951).

The subjects' whole perceptual processes had operated in such a way as to clarify the ambiguous color sensations derived from the stimulus patches by interpreting them as resembling the customary color of the objects represented.

In no situation is the individual isolated from all previous experience. Therefore, he always perceives his environment not with a blank mind but with an expectancy—or hypothesis—about what he is going to see (Bruner, 1951). He is always prepared to see, hear, smell, or feel some particular type of thing because preceding events have aroused certain processes of knowledge or motivation. When he receives the actual stimulus from the environment, his perceptual processes will enable him to confirm or correct his expectation. If the original hypothesis or expectation is very strong, either because it has been confirmed many times in the past or because it is strongly motivated, the environmental stimulus will have to be much stronger to prove it false. The individual is likely to see what he expected or wanted to see, regardless of contradictory stimuli.

Organic condition. The importance of the individual's organic needs as a factor in perception has been demonstrated clearly in experiments with hunger.

In one experiment a group of college students were shown black and white drawings of ambiguous objects at periods of one, three, six, and nine hours after they had eaten. At the end of the three and six-hour periods, subjects showed a sharp increase in the number of food or food-related objects which they perceived in the ambiguous draw-

ings. The frequency of such responses fell off in the test conducted nine hours after eating but nonetheless remained higher than at the one-hour testing (Levine, Chein, and Murphy, 1942).

The fact that the number of food-related responses fell off at the nine-hour testing coincides with evidence (Chapter 5) that, even though the organic need does not decrease, sensations of hunger actually fall off in intensity after the individual has gone without food for some time.

In another experiment on hunger and perception, performed with Navy personnel, it was found that hunger had the effect of increasing the apparent *size* of food objects perceived in ambiguous stimulus situations (McClelland and Atkinson, 1948).

Personal adjustment and needs. A number of experiments have shown a relationship between the individual's needs and values and his perception of the people and objects in his environment. One recent experiment, for example, demonstrated that an individual's degree of personal security will influence his social perceptions, as shown by the way he estimates the size and location of people's faces (Smith, 1954).

Photographs of two friendly and two unpleasant faces were used in this experiment. The subjects operated a size-distance apparatus consisting of a twelve-foot table divided into two parallel viewing lanes. In the right lane the subject could control the size of a projected image of a face and interpret the changes in the size of the face as changes in its distance from himself. In the left lane five posts were well illuminated so that the usual cues for distance could be utilized. The subject's task was to adjust the image in the right lane so that it appeared to be opposite the third post in the left lane. The results confirmed those of a previous study (Smith, 1953), which had shown that friendly faces were made to appear closer to the subject than unfriendly faces.

As a further step in this follow-up study, however, the subjects were ranked according to their settings of all four faces. All subjects were given the Bell Adjustment Inventory and the Knutson Personal Security Inventory. When the eleven subjects who tended to bring the faces closest to themselves were compared with the eleven who kept the faces farthest away, it was found that the former were better adjusted and more secure in their personal lives than the latter.

Another personality factor which has been tested in relation to perception is willingness to tolerate a relatively unstructured, ambiguous situation in the environment (Martin, 1954). Some individuals seem to feel a greater need than others to know at all times exactly "where they stand" with regard to their environment, physical or social. In an ambiguous situation they are more likely to "guess" at an interpretation than to tolerate uncertainty.

As a test of this trait in relation to perception, male college students were given a vague task, such as sorting a pile of blocks of different colors and sizes any way they liked or describing themselves as they pleased. Their score on this part of the experiment was the number of questions they asked in an effort to define their tasks more clearly. The answers given them were very noncommittal.

Later, the same subjects, while wearing special lenses which made a card table appear to tilt, were asked to estimate the number of inches the table tilted. The subjects who took longest to see this illusion and who then saw a smaller amount of tilt were the same ones who had been least able to tolerate ambiguity in the first test. The lenses had been adjusted to cause only enough distortion to exaggerate the normal conflict between immediate sensory impressions and the tendency to preserve a constant environment (Martin, 1954).

It is scarcely surprising that the men who tended to suppress their immediate sensations in order to maintain perceptual constancy were the same ones who had tried to reduce the ambiguity of a vague interpersonal situation. Both types of behavior are aimed at preserving a well-structured environment—a form of homeostasis.

Several other studies have highlighted the relationships between perception, on the one hand, and individual needs and values on the other. The effect of need for achievement, or personal success, on perception of ambiguous stimuli was investigated with college students as subjects.

Subjects were divided into three groups and given a test. Following the test the members of one group were led to believe that their performance had been very outstanding, whereas those in a second group were led to believe that they had failed badly. A third group acted as controls. All subjects were then shown lantern slides which were blank except for

a few dim smudges. The slides were shown in very dim illumination. As each slide was projected, the subjects were told in a general way what it represented and then asked a question about it:

Three men. What vocations do they represent?
Some books and some dishes on a table. Which are there more of?

The scoreboard at a ball game. Give the score for the home team and for the visitors. Note which is the home team's score.

The amount of a monthly paycheck. What is the amount?

The responses of the success group and the failure group were then compared with the responses of the control group. The clearest results were obtained in the case of the slide which was accompanied by the verbal suggestion of a monthly paycheck. Failure increased significantly the amount of money seen on the paycheck. Of the failure group, 70.4 per cent saw the check as being greater than \$100; of the control group, 40.4 per cent; and of the success group, 34.5 per cent (McClelland, Atkinson, and Clark, 1949).

In our society, money seems to many people the common denominator of success, or at least an important and recognizable attribute of the successful person. It is not surprising, therefore, that the subjects who felt the greatest need for success—that is, those who had just experienced failure—tended to exaggerate the value of the “paycheck.”

Various other studies have also suggested the importance of values and needs in perception (Ashley, Harper, and Runyon, 1951; Lambert and Lambert, 1953). The following experiment is typical.

A group of thirty ten-year-olds were asked to manipulate an apparatus consisting of a wooden box with a screen at one end and a knob at the lower right-hand corner. By turning the knob the children could vary the diameter of the circle of light shining on the screen. Two groups of children, one rich and the other poor, were asked to match the size of the circle of light to the size of coins of various denominations; a control group matched the light to the size of cardboard circles. The coins, socially valued objects, were judged larger in size than the discs. Furthermore, the poor group overestimated the size of the coins to a much greater extent than did the rich group (Bruner and Goodman, 1947).

It is only fair to point out that some psychologists have not accepted the conclusions

of this and similar experiments. In fact, one complex study has indicated that perception in situations of this kind is affected much less by values than by the difficulty of the size-estimation task.

In this study subjects were asked to estimate the size of blank discs and of discs containing a dollar sign, a Nazi swastika, a neutral figure consisting of an X in a square, and other neutral figures similar in shape to each of these. One group was composed of European refugees who felt strongly hostile to the swastika symbol; another was made up of American-born secretaries who were expected to have a strong positive feeling for the dollar sign.

Results indicated that intensity of value and degree of value significance had no consistent influence on error of size estimation. Even refugees who felt so strongly against the swastika as to protest against its use in the experiment did not show distorted judgment of its size. Under the best possible conditions for judging, subjects tended to underestimate; under conditions equivalent to those used in some of the earlier studies, most errors were in the direction of overestimation. Particularly significant was the finding that certain individuals in both groups consistently tended to overestimate, while others tended to underestimate the size of all discs, regardless of value significance (Klein, Schlesinger, and Meister, 1951).

Although values and needs undoubtedly influence perception to some extent, further research is needed to determine just how much and in what way, as well as the extent to which individual differences also play a part (McCurdy, 1956).

Perhaps the most extensive study thus far of the relationship between perception and the broader aspects of personal adjustment was a complex series of experiments which extended over a period of ten years (Witkin *et al.*, 1954). This study included a variety of perceptual tasks, most of which were designed to measure the subject's ability to perceive an item accurately, regardless of changes in the total field of perception.

In general all the tests fell into either one of two classes: (1) Some emphasized the separation of an item from the surrounding perceptual field. An example of this was the rod and frame test, in which the subject viewed a luminous rod in a rectangular frame. The rod or the frame or the subject's chair,

or all three, could be tilted at will by the examiner. The subject's task was to state when the rod was in a vertical position. This, of course, involved perceptual ability to separate the rod from its frame. (2) Other tests encouraged acceptance of the perceptual field as a whole. An example of this was the tilting-room-tilting-chair situation, in which the subject sat in a small room with battleship gray walls, outlined with white stripes. The front wall had two additional vertical stripes, plus one horizontal stripe and two framed pictures. The room or the chair, or both, could be tilted to the same or opposite sides. The subject then tried to perceive when his body was in a vertical position. In addition to these and other space orientation tests, there was a test of ability to perceive objects of constant brightness regardless of background; an embedded figures test; a test in which conflicting visual and auditory stimuli were given; a hand-coordination test; and two body-action tests involving ability to maintain balance or stay in an upright position as the visual field was changed.

The subjects in these experiments included approximately 50 normal young men and 50 normal young women: 38 male and 39 female patients in a mental hospital; and 30 boys and 30 girls, all normal, aged 8, 10, 13, 15, and 17. In addition to various perception tests, all subjects took a comprehensive battery of personality tests, including the Rorschach inkblot test, a figure-drawing test, the Thematic Apperception Test, an interview, and a personality questionnaire.

Certain definite relationships between basic personality patterns and perceptual abilities emerged from the study. Some subjects found it very difficult to break down the perceptual situations in which

they found themselves. They reacted to the total field of perception rather than isolating the relevant factors from the context. Others were much less dependent upon the field and could readily extract a given item from the total configuration.

When the personality test data were analyzed and correlated with the perception tests, the degree of dependence upon the total perceptual field was found to be related to the following factors:

1. *The nature of the individual's relation to his environment, including other people.* Field-dependent perceivers were generally passive, tending to depend upon the support of others and to submit willingly to authority. On the other hand, those whose perception was most analytical—who were able to separate an item from its context—showed a general capacity to initiate and organize activity in other phases of life and a tendency to struggle against social forces rather than submit to authority.

2. *The way the individual manages his strivings and impulses.* On the whole the field-dependent persons tended to be afraid of their sexual and aggressive impulses and hence to have rather poor control of them. They showed more evidence of anxiety than did the analytical perceivers, who tended to accept their hostile and sexual impulses and to control them more effectively.

3. *The kind of concept the individual has of himself.* A low degree of self-acceptance and self-esteem, including a low evaluation of the physical body, was characteristic of field-dependent subjects; whereas the independent perceivers showed high degrees of self-confidence and self-esteem.

On the whole the three factors are closely related, since the person with low self-esteem tends to fear his impulses and hold back from an active struggle with environmental forces. However, the three field-dependent patterns do not inevitably go together. One may, for example, have a poor self-concept combined with a neurotic need for active opposition to a hostile world. In the above experiments, inability to separate an item from its context was usually associated with some degree of emotional immaturity, although here again there were exceptions. Perception performance appeared to be more closely related to an individual's way of dealing with his environment and his own strivings than to his concept of himself.

Age differences. In the Witkin experiments described above, the ability to separate an item from the surrounding field showed marked changes with age. The eight and ten-



The above apparatus was used by Witkin in the rod and frame test.



This figure of a violin player, modeled in clay by a totally blind eighteen-year-old boy, represents one type of sculpture done by the blind. Features of special significance to the artist are exaggerated, while other features, of which he is less aware, are minimized or omitted entirely.

year-olds were greatly dependent upon the field. This dependence decreased dramatically between the ages of ten and thirteen, and continued to decrease slightly until the age of seventeen. After seventeen, however, subjects were more field-dependent again.

At each age level there was, of course, a wide range of individual differences. Furthermore, at all ages people tended to be self-consistent in their perception under different conditions (Witkin *et al.*, 1954).

✓**Sex differences.** Another finding from the Witkin experiments was that females showed more field dependence than the males. This was true to some extent at all ages, but only after the age of seventeen did the difference

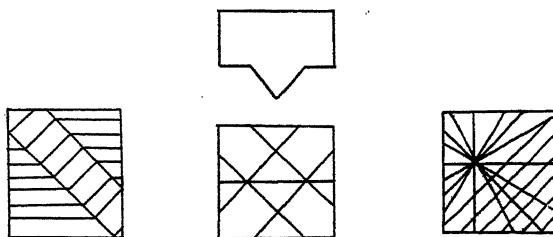
become significantly large and appear under all test conditions. In general, women tended to depend more upon visual cues, whereas men paid more attention to sensations from their bodies. However, women also utilized bodily cues when necessary, which partially explains why their performance was more variable (Witkin *et al.*, 1954).

The investigators in this study felt that the more active, analytical approach of men to perceptual tasks was related not only to their more active biological role but also to cultural demands for an active masculine role. We have met this same masculine ability to analyze and restructure problem situations in our discussion of intelligence (Chapter 4).

An independent investigator has confirmed these findings about sex differences in perception in a study dealing with reversible and embedded figures.

Fifty-two college students, half of them men and half women, were shown a reversible figure (similar to that on page 264) and were asked to indicate, by pressing a key, when the figure first changed and every time it reversed thereafter. For the men the figure reversed more quickly and more often than for the women. In another part of the experiment subjects were shown a series of simple and complex figures in which the simpler ones were embedded (similar to those shown below). The men were able to find the embedded figures significantly faster than the women, thus indicating superior ability to restructure the perceptual field (Newbigging, 1954).

The tendency of women to depend on visual cues more than men do has been demonstrated in tests which measured the ability to locate sound when visual and auditory cues conflicted (Witkin, Wapner, and Leventhal, 1952).



The simple figure on top is embedded in all the more complex figures below it. Can you find it in each one?

Another experiment showed that women are less subject than men to the perceptual illusion of "autokinetic movement." This illusion occurs when a person is brought into a dark room and asked to observe a small, stationary point of light. Nearly always the light will seem to move.

Experiments dealing with this illusion were performed on fifty-two men and fifty-one women. The women reported seeing no movement of the light three times as often as the men did, and those women who did see movement did not see the light move as far as the men did. Furthermore, most of the women realized that the movement was an illusion after only a few trials, whereas the majority of the men believed the light really moved. Some refused to believe that it was stationary even after the experimenter explained the nature of the experiment (Chaplin, 1955).

These various experiments would seem to indicate that the mere fact of being a man or a woman can make an important difference in how we perceive, not merely a pretty girl or a handsome man but many other objects in our environment.

SOCIAL FACTORS

Cultural influences play a vital part in perception. Much of the influence of culture derives from its importance in determining the direction of attention. For example, primitive tribes often develop powers of observing distant wild life that few of us could equal, except perhaps hunters or members of the Forestry Service. The American child learns to discriminate many shades of color, while the Chukchee tribe living in Siberia fail miserably on color-matching tests but can discriminate over two dozen different patterns of reindeer hides, many of which would look identical to us (Bogoras, 1909). Recent investigators have not experimented with illusions on primitive peoples, but one early field worker found that certain native groups in the Torres Straits area were much less subject to the Müller-Lyer illusion (page 12) than Europeans were (Seligman, 1901). Their use of spears with heads which resembled the Müller-Lyer figure may have accounted for their immunity to the illusion. It seems possible, therefore, that culture may affect specific perceptions directly. At the very least it has an important indirect influence on our

perceptions by virtue of its role in shaping our personal needs and motives.

Reaction to social taboos. Cultural influences on perception are clearly demonstrated in our reactions to social taboos. Experiments have shown that we perceive words connected with cultural taboos much less readily than neutral or pleasant words. This phenomenon, known as *perceptual defense*, has been studied with an instrument called a tachistoscope which permits the subject to view words or pictures for as short a time as .01 second. The shortest time of exposure required for the subject to identify a given word is known as the threshold for that word.

In one such study, college students were shown a list of eleven neutral words and seven taboo words, including terms like "belly," "raped," and "bitch." Thresholds of recognition were higher for the taboo words. To test the hypothesis that taboo stimuli arouse unconscious reactions before being perceived consciously, the investigator took galvanic skin responses (Chapter 6) on subjects prior to their perception of the various words. The GSR was higher before taboo words, indicating the presence of greater emotion (McGinnies, 1949).

In a subsequent study twenty normal adult men employed as firemen and seventeen schizophrenic male patients were asked to recognize a list of taboo and neutral words. In this list the neutral words were carefully chosen so that they would occur in the language with the same frequency as the taboo words. This was in answer to an objection made to the above study on college students: namely, that the taboo words were used much less frequently than the neutral words ("apple," "dance," etc.) and that this alone would tend to make them harder to recognize. The follow-up study, therefore, used such neutral words as "anvil," "bison," and "stoke," which were in less common usage than the neutral words of the first study. Again the thresholds of recognition were significantly higher for taboo words. This was true for normal and schizophrenic men. The latter showed higher thresholds for all words than did the normal men (McGinnies and Adornetto, 1952).

A third study of perceptual defense was made in the effort to show that a real lag in perception was occurring rather than merely a reluctance to verbalize the word after it had been perceived.

In this experiment the words again were selected according to frequency, but this time they were

presented in pairs. That is, a "pre-task" word, sometimes taboo and sometimes neutral, was first presented for an interval of two seconds. Then the "task" word, always a neutral word, was presented for .01 second. If it was not recognized, the pre-task word was again exposed for two seconds, followed by the task word for 0.02 seconds. This was done until the task word was finally recognized. When the pre-task word was a taboo word, the threshold for recognition of the neutral task word associated with it tended to be higher than when the pre-task word was neutral (McGinnies and Sherman, 1952).

Since there would be no reluctance to speak the neutral task words, these findings seem to indicate that the perceptual defense, or interference, against the taboo pre-task words spread to the task words that followed.

Social suggestion.—A more specific cultural factor is the influence of social suggestion upon our perception of various objects. We have already seen (page 269) how readily social suggestion can influence the direction of our attention, at least momentarily. In a similar fashion, we also tend to perceive an object in the same way as those around us.

One well-known experiment has shown the influence of social suggestion on the perception of movement.

This experiment made use of the illusion of "auto-kinetic movement." The subjects were brought into a dark room and told to look at a small spot of light. Although the spot was stationary, it appeared to move because there were no reference points in the darkened room. The reported extent of the auto-kinetic effect was studied for subjects tested singly and in groups. In the individual tests the estimate of movement showed wide variation from subject to subject. When the subjects were put in groups of two or three, however, the data from each individual tended to approach the average of his group (Sherif, 1935).

In other words, social influences caused the subjects to make estimates in conformity with those of their fellows. More recent experiments have corroborated the finding that social pressure often influences perceptual organization (e.g. Schonbar, 1945). Another study showing the effect of social suggestion on perception is given on page 383.

Advertising. People with a product to sell make use of the fact that people tend to perceive what they are seeking. Thus advertisers try to build up an expectation of desir-

able qualities in their products. Some of the best illustrations of this are found in the field of cigarette advertising. Cigarette manufacturers make distinctive claims for the taste, aroma, and soothing qualities of their particular brand, and habitual smokers profess to have deep-seated preferences for one kind of cigarette over another. Yet "blindfold tests" (conducted by psychologists rather than the manufacturers) have shown that relatively few smokers can accurately identify different brands when they cannot see the label (Husband and Godfrey, 1934). The same thing is apparently true of different brands of cola. (Pronko and Herman, 1950).

Subliminal Stimuli.—Recently the popular press has carried numerous articles on the subject of subliminal stimulation as a factor influencing our perceptions and actions. There is good evidence that stimuli of which we are not aware can control our actions. The implications of this fact for advertising and propaganda are numerous and have been viewed with alarm by some thoughtful popular writers who fear that some sinister group might influence people to perform harmful acts.

The following experiment leaves little doubt as to the actual effect of subliminal stimulation on perception.

Twenty neurotic patients in a hospital were asked to describe a face seen in an exposure apparatus. The exposure of the face was interrupted at regular intervals by the rapidly exposed words *happy* or *angry*. The words were exposed for split-second intervals so short that the subjects could not consciously read the word.

The face was more often seen as pleasant when paired with the subliminal word *happy* than when paired with the subliminal word *angry*. Obviously, then, words not consciously read can influence what we see (Gudmund, Smith, and Klein, 1957).

It is far too early, however, to attempt to evaluate this phenomenon. Much more research is needed to determine its conditions and limits.

SPACE PERCEPTION

One of the most important adjustments we make to our physical environments is perceiving the size, location, and physical qualities of objects in three-dimensional space.

When we look at a parked automobile, we perceive it as a three-dimensional object of a specific size and shape located in a specific place. If the automobile is moving, we judge its speed in terms of its changing relationship to other objects in space. If we hear only the honking of a horn, we use certain perceptual cues to judge the distance and direction from which the sound is coming.

THE PERCEPTION OF PHYSICAL OBJECTS IN SPACE

How can the human retina—a curved, two-dimensional surface—perceive a world of three dimensions? The short answer to this question is that depth is inferred from various kinds of raw sensory data. But the manner in which this is done is as complicated as it is wonderful.

Seeing depth and distance with one eye. Although binocular (two-eyed) vision is necessary if we are to receive the greatest number of possible cues about depth and distance, we can perceive these characteristics of an object even with monocular (single-eyed) vision. In addition to the cues arising from the stimulus pattern itself, which we will discuss shortly, we get cues from the stimulation of muscles in and around the eye.

The muscles responsible for the various eye movements possess tiny sense organs which are stimulated when the muscles contract. For every position of the eye there is a corresponding pattern of stimuli from the muscles which tells us how far the eye has moved and where it is at a given moment. For example, the lens of the eye bulges out when we look at close objects and flattens when we look into the distance. The shape of the eyeball itself probably changes also. Each degree of bulge in the lens and the eyeball gives rise to a characteristic pattern of stimulation and thus provides cues by which we perceive the distance and depth of the object being seen. Additional cues are derived from the stimulation of the muscles involved in turning the head to look at an object.

Seeing depth and distance with two eyes. The superiority of normal binocular vision is based on the depth cues provided by the convergence of the eyes and the difference in retinal pictures.

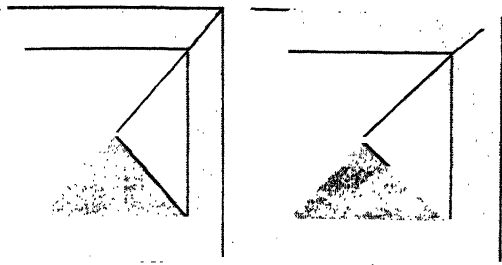
Convergence. Normally the two eyes converge in looking at a single point or small

area. To illustrate convergence, hold the tip of one finger as far away from you as you can and look at it with both eyes open. Then bring it closer and closer to your eyes until it fairly touches your nose. Observe how the sensation of muscular strain in the eyes increases as the finger comes closer. This cue is not available to the one-eyed person in the same degree, as you can see by repeating the above experiment with one eye closed. When looking at objects thirty feet or more away, however, the two eyes become practically parallel. Beyond this point convergence has little value as a basis for perceiving depth.

Differences in retinal pictures. Differences in the image which each eye gets of the same object also help us to know its depth and distance. Cover your left eye and study carefully some solid object close by, such as a book. Now, without changing the position of your head or eyes, shut off the vision in your right eye instead. Notice the difference in the retinal picture. With the right eye you see more of the right side of the object; with the left eye, more of the left side. This condition is often referred to as *retinal disparity*. It is a normal condition of vision, and we have learned to interpret distance by automatically comparing the two slightly different retinal images.

The stereoscope, which was found in every front parlor a generation ago, is a commercial application of this principle. The pictures for use in this apparatus are taken by two cameras mounted a slight distance from each other. When the two pictures are viewed, one by each eye, the effect is that of a single, three-dimensional picture. By increasing the distance between the two cameras, it is possible to increase the illusion of depth up to a certain point. When the two views become too different, however, they no longer merge in perception but are seen alternately by first one eye and then the other.

The stereoscope has been adapted for the study of aerial pictures taken from different points in flight. Naturally, as the plane travels, the angle from which an object is photographed changes. For example, the diagrams on page 283 show the top of a monument as it might look from two positions. These two diagrams can be used to demonstrate the stereoscopic principle. Take a piece of cardboard ten to fourteen inches long and place it vertically between the two figures. Next, hold



your head in contact with the upper edge of the cardboard so that the left eye sees only the diagram on the left and the right eye sees only the diagram on the right. The two flat images will fuse into a solid which appears to be located at a position between the two drawings.

Cues from the stimulus pattern. Whether our vision is monocular or binocular, we receive several additional cues about depth and distance from the stimulus pattern itself. Among these are cues based on distinctness, linear perspective, texture, light and shadow, relative position, and known standards. All contribute to the fund of raw data which perception organizes into a meaningful whole.

Distinctness. Because of dust and smoke in the air, objects which are a long way off appear to be blurred and indistinct in outline. Details which we know to be there may not be observable. The extent of the dimming depends on the distance, and we learn to interpret distance in these terms. When the characteristic condition of the air changes, we often judge distances incorrectly. For example, to the person reared in a smoky industrial city, the distance of objects seen through clear mountain air is greatly underestimated. A tenderfoot at the dude ranch will amuse the old hands by announcing that he will ride to a certain hill and back before breakfast, only to learn that the hill is really a mountain some forty miles distant. This phenomenon is sometimes called *atmospheric perspective*.

Linear perspective. Objects appear both smaller and closer together as they become more distant. We are all familiar with the way railroad tracks or the edges of a highway appear to meet on the horizon. Likewise, uniformly spaced objects such as telephone poles appear to be spaced more closely as they recede into the distance. These phenomena of linear perspective are used by artists to represent distance in pictures.

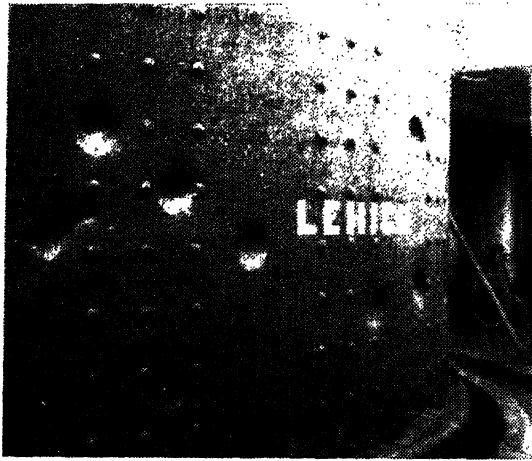
Texture. Closely related to linear perspective is the factor of texture. On any surface not perpendicular to the line of sight, the texture elements appear denser as the surface recedes. In the picture below, the clods of a rough plowed field appear closer together—that is, the texture of the field seems denser—in the distance than close to us. Thus texture is an adjunct to linear perspective, operating in situations where there are no converging parallel lines.

In testing his theory that the fundamental cues by which space is perceived are impressions of surface and edge, one investigator found that subjects viewing slides which showed a gradient of density perceived the surfaces as slanting (Gibson, 1950). The fine-textured portion seemed further from the viewers. The slant of a regular surface seemed greater than that of an irregular one.

Light and shadow. When light strikes an irregular surface, as for example the human face, certain parts are brightly illuminated and others are cast in shadow. The appearance of these shadows tells us much about the depth of the parts concerned. The artist uses shading and highlights to convey the notion of depth on a two-dimensional canvas.

Relative position. When two objects are in the same line of vision, the nearer one con-





As shown above, light and shadow often serve as cues to depth. The tank appears to have large dents and small bulges, but if the book is turned upside down, the tank appears to have large bulges and small dents.

ceals all or part of the farther one. Near objects usually appear at the bottom of the two-dimensional field of vision, distant objects at the top.

Known standards. We soon learn that men are about sixty-eight inches tall. Once we are familiar with the height of a particular man, he seems to be that tall regardless of whether we are looking at him from a distance of a few feet or a hundred yards. If the size of the retinal image representing a man is small, the man is seen as far away; if the retinal picture is large, the man is seen as close to us. The converse of this can be illustrated very simply. Gaze intently at a colored square of paper. After about a minute, turn your gaze on a flat surface several feet farther away. The image will now seem larger. Remember that the size of the retinal image does not change as we alter the distance at which our gaze is directed. Its perceived size changes through our interpretation of it. This interpretation has become automatic in the adult, but it is often lacking in the child. A small child often will think that a man seen in the distance is a boy.

THE PERCEPTION OF MOTION

Movement is simply the progressive change of an object's position in space with time. It is not necessary for the object to be perceived in all of the intermediate positions in order

for it to be seen as moving. In fact, the eyes never follow a moving object with sufficient precision to keep it in full view at all times. Here again, perception is a process that fills in the blanks.

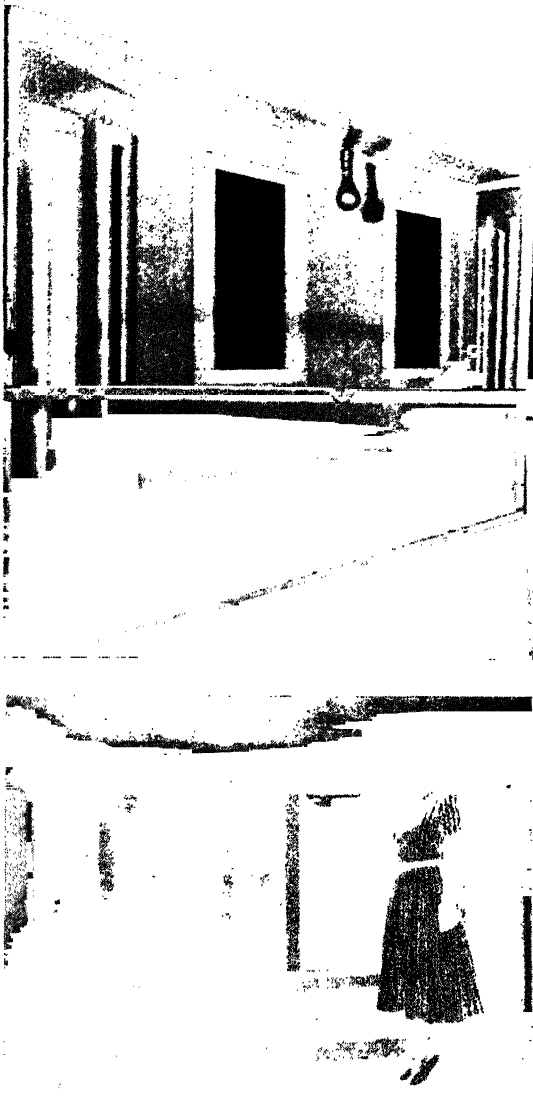
Relative motion. When you look from a rapidly moving automobile, near objects seem to pass by more rapidly than those at a moderate distance, while those very far away may actually seem to be going in the same direction you are. Hold a finger at a distance of one or two feet from you and look at it intently. Then, without changing your fixation, move your head. Which way do objects beyond your finger seem to move? Now look at the distant wall and move your head. Which way does the near object seem to move?

Relative motion is also interpreted in terms of known standards based on experience. When we are traveling in a train or automobile, we are able to judge our speed fairly accurately by looking out the window and noticing how rapidly nearby objects are passing by. We can make this estimate because of past experience.

On their first airplane flight, many people underestimate the speed of the plane because the ground below seems to disappear so slowly to the rear. When we move at 75 miles per hour on a train, the ground outside seems to fairly streak by. But when we travel at 300 miles per hour at 12,000 feet, the ground below seems almost motionless. As he gains in air experience, the traveler develops new standards by which to interpret these visual cues and so can judge the speed of his plane much more accurately.

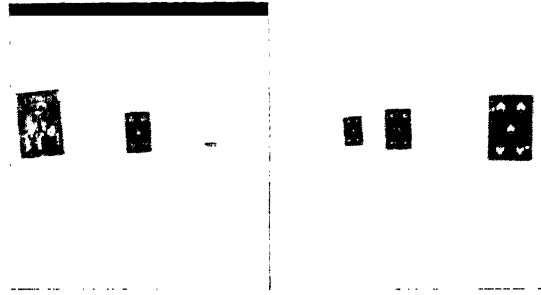
Radial motion. By radial motion we mean movement directly toward or away from the observer. Continuous radial motion is perceived when the size of the retinal image continuously changes.

In a recent study confirming this, observers viewed a diamond-shaped spot of light which actually moved back and forth and also a stationary light which was systematically varied in size. Both spots appeared to move. When viewed with only one eye, the spots appeared to move about the same distance. When viewed binocularly, however, the spot of light which really was in motion appeared to move farther than did the stationary light. When observing the stationary light alone in a well-defined field, the subjects found it difficult to decide whether it really was moving or not (Ittelson, 1951).

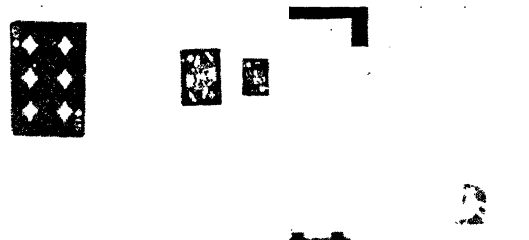


This experiment also confirmed the fact that the perception of radial motion depends partly upon the individual's assumptions regarding the true size of the observed objects and the constancy of their size. The changing size of the retinal image, meaningfully interpreted in the light of these assumptions, gives him his perception of motion.

Why motion pictures move. The so-called motion picture is simply a series of still pictures flashed on a screen one after the other at a rate of fifteen to twenty-five per second. The pictures of the original scene are taken at about the same rate. How is it that we can see this series of separate, still pictures as the



These pictures show some of the devices used in perceptual research at the Psychology Research Center, Princeton University. The distorted room (above, left) appears normal when a person views it with one eye, with his chin resting on the hollow in the cross-bar. In a similar room (lower left) two women of about equal height appear to be very different in size as long as the room is seen as normal. In the top picture, watch, card, and magazine appear to be side by side, but the three cards appear to be at different distances from the observer. The nature of the objects seen is as important as their geometrical relationships in determining their apparent distances. In the picture below, the ace is seen as larger than normal and at the same distance from the viewer as the white board because their edges coincide. Actually, the ace is the same size and at the same distance as the queen (Ittelson, 1953).



same object or objects in smooth, continuous motion? Why do the movies not "jump"?

In the motion picture, as in life, objects are seen in successive positions in space. When the gaps between are not too great and when the successive positions are perceived rapidly enough, the perception of continuous movement takes place. The motion picture, in other words, is merely an application of a fundamental fact about the visual perception of motion.

The motion-picture camera can be used to "speed up" some action so that it can be studied more easily. Fewer than twenty-five pictures per second are taken; then when

these pictures are shown at the standard speed, the action progresses much more rapidly than it would in real life. In this way, you can see a flower burst into bloom before your very eyes within a few seconds.

The rapid action of an athletic contest, on the other hand, can be "slowed down" by taking *more* than twenty-five pictures per second and showing them at the standard rate. This method of slow-motion pictures is used by athletic coaches to observe and point out to players the good and bad points in their performances and by industrial efficiency experts to study the least time-consuming motions for performing a standard factory task. Recent developments in cameras and film have made it possible to slow down or stop bullets and projectiles of highest velocity so we may see clearly how they accomplish their work of penetrating armor and other substances.

THE PERCEPTION OF SOUND IN SPACE

It is a well-known fact that people are able to locate the position of sounds in space. Such localization is reported in terms of distance



Wonderful as our eyes are, there is much that they miss. For example, who would suspect that a football would be pushed in as far as this picture shows it to be? Just as you can pass your finger quickly through a candle flame and feel no pain, so you can watch a very rapid motion without actually seeing it.

and direction. This ability to locate sound has considerable adaptive value in modern life. For example, in crossing a busy street your very life may depend upon your knowing accurately the position from which an unseen automobile is bearing down on you.

Perceiving the direction of sounds. Our ability to localize sounds is due almost entirely to our possession of two ears located at different points in space. Careful study of the diagram at right will show you how a given sound wave stimulates the two ears differently in three distinct ways:

1. The sound coming from the whistle at the left of the head strikes the left ear before the right. This difference in time can be very short, but it tells us from which side the sound is coming.
2. Notice also that the sound waves coming from the left stimulate the left ear more strongly than they do the right ear.
3. As you remember from the preceding chapter, sound waves consist of areas of high and low pressure. Since the two ears are at different points in space, a sound wave will be in different phases as it stimulates the two ears. Sound waves travel very slowly as compared with light waves, with the result that differences in phase in sound waves are appreciable.

We can use these several cues to direction only when sounds come from one side or the other. Sounds directly in front of us cannot easily be distinguished from those directly above or behind us because the two ears are stimulated identically.

The essential principle of the human ear has been reproduced in various types of equipment for accurately detecting the direction of sounding objects. We can greatly increase the accuracy of our auditory perceptions if we use two sensitive microphones. These are set apart at a distance much greater than that of the human ears. Such instruments are used in listening for approaching airplanes and distant guns. Once the lateral direction of the object has been established by turning the microphones until each sound comes in with equal intensity, the angle of the object above the earth can be determined in similar fashion with one "ear" above the other.

Perceiving the distance of sounds. Two clues help us to determine from how far away a familiar sound is coming—the *loudness* and the *timbre*.



In the ear closer to the whistle the sound wave arrives first; is stronger; is in a different phase.

The farther away its source, the weaker the sound will be. The ear-splitting locomotive whistle heard in the station becomes fainter and fainter as the train moves into the distance.

The sound of familiar objects changes in timbre as their distance from us increases. The farther away the sound is, the purer it will be. The tinny jangle of the cheap phonograph gives way to mellow music when heard in the distance, as from across a lake. This increase in purity results from the loss of the irregular sound waves (or noise) and from the loss of certain shrill overtones, which lack sufficient energy to carry very far.

TIME PERCEPTION

On certain occasions we all feel like the poet who wrote,

"Backward, turn backward, O Time in
your flight!
Make me a child again, just for
tonight."

Or we wish that we could do something to prolong the pleasant hours that hasten by—or to shorten the long ones of sadness and boredom.

Although most people today are subject to the dictates of accurate clocks which measure fixed intervals of time, every person perceives those identical intervals somewhat differently. The same hour of class that speeds by for the professor who is "wound up" on his favorite subject will drag for the athlete who wants to get out of class and go to football practice.

Many factors influence our perception of time. Among these are a sense of the sequence of events, a memory of the past, a feeling of how long it has been since a certain event occurred, and an orientation toward the future. Among many primitive tribes who tend to measure time in terms of social events or tasks rather than in units of duration, time perception is less complex. For example, the Trobriand Islanders near New Guinea have neither past nor future tenses in their verbs. All events, real and mythical, are regarded as taking place in a sort of universal present (Lee, 1949). In our culture, however, a loss of the sense of the past is tantamount to a loss of personal identity.

PERCEIVING SHORT INTERVALS

Many lines of evidence convince us that the mechanisms involved in the perception of short intervals are quite different from those we use to tell longer periods. On the whole, we can estimate short intervals up to five or six seconds most accurately. In judging periods of an hour or more we tend to depend upon such cues as how much has happened or how much we have accomplished. ✓ Certain other creatures seem to be superior to man in their ability to judge these longer periods of time—bees, for example, have been trained to come to a particular place for sugar every three hours, or even every six hours, with only a few minutes' error (Cohen, 1954). ✓

✓ It has been found that people's auditory discrimination for time is finer than their visual discrimination. The average person can perceive two sounds as successive rather than as continuous if they are separated by only two milliseconds; two visual experiences, on the other hand, must be fifty milliseconds apart. If one experience is visual and the other auditory, eighty milliseconds must elapse between them or they will seem simultaneous (Cohen, 1954). ✓

PERCEIVING LONG INTERVALS

When you go to bed, can you "set" yourself to wake at any designated hour, regardless of how sleepy you are or of how soon that hour is to arrive? Some people can do this so accurately that they do not need alarm clocks. The reason for this is that most of our physiological processes are correlated nicely with time. ✓ Many internal changes reveal the passage of long intervals of time, whether we are awake or asleep. There is a distinct rhythm in our periods of hunger. The tension on the bladder increases with the passing of time until it is relieved. As time passes in waking activity we become more and more tired. The "time to go home" usually becomes apparent to us without our having to look at a clock. ✓

FACTORS AFFECTING PERCEPTION OF TIME

Physical time, like physical space, is perceived differently according to a variety of

conditions within the perceiving individual. The factors of age, intelligence, activity, and motivation have been studied in considerable detail.

Age and intelligence. In spite of wide individual differences in speed of acquiring time concepts, the ability to perceive time follows an orderly course of development. According to one study (Ames, 1946), the present is recognized first, with such words as "now" and "today" being used at about two years of age. Future concepts appear next, with "tomorrow" preceding "yesterday." By the age of four the three tenses of past, present, and future are used about equally and many specific phrases dealing with time appear in the child's speech. The majority of children in this study—children of high average to very superior intelligence—were unable to tell time by the clock until they were seven years old.

A study dealing specifically with children's knowledge of clock time also shows the orderly development of time concepts.

The subjects in this study were eighty-nine children aged four to six who had been given no instruction in telling time at the pre-school where they were enrolled. In telling what time of day certain activities took place, the youngest ones tended to use descriptive terms such as "early" or to use a sequence of activities such as "after nap." The next stages were to give an unreasonable time, then a reasonable but incorrect time, and finally the correct hour. Thus when asked what time they left school, 41 per cent of the four-year-olds gave unreasonable times, whereas 74 per cent of the six-year-olds were able to name the correct hour. Telling time by the clock preceded being able to set the clock and to understand why the clock has two hands. Whereas only 4 per cent of the four-year-olds were able to set the clock at 2:00 and 9:00, 45 per cent of the six-year-olds could set it at 2:00 and 35 per cent at 9:00. Half and quarter hours were more difficult both to recognize and to set. One interesting error made by a few children at each age level was to mistake 12:30 for six o'clock. Their comments revealed that a favorite radio program came on at six o'clock, and they had learned to watch for the hands to be "straight up and down" (Springer, 1952).

An interesting topic for further research would be the effect of radio and television on children's time perception. It may well be

that the desire to view or hear favorite programs every day stimulates interest in time. Accuracy in judging intervals of time may also be affected by the regular experience of quarter-hour and half-hour programs, thirty-second intervals for station identification, and so forth. It has been pointed out that the division of the school day into regular periods, with a bell ringing at the end of a given interval, aids the child in estimating the passage of time (Hurlock, 1953). Certainly his accuracy in judging intervals of time improves enormously between the tenth and the sixteenth years, as shown in the table below (Elkine, 1928).

Errors of Children (Aged 10 to 16)
in Estimating Time Intervals

Age of children	Average error in estimating a five-second interval	Average error in estimating a five-minute interval
10 years	4.1 seconds	170 seconds
16 years	1.6 seconds	91 seconds

There is considerable evidence that the increased accuracy of time estimation with age is determined by a parallel increase in intelligence rather than by the mere fact of more experience. Feeble-minded persons have difficulty in correctly estimating the passage of time, their accuracy being equalled by normal individuals who are chronologically much younger (Brower and Brower, 1947).

Time as measured by the calendar seems much shorter to the older person than to the child. The French psychologist Pierre Janet noted that the apparent length of a given period of time seems to be in inverse ratio to the total length of the individual's past life. Adults in middle life or old age often are unable to state whether a particular event occurred last year or the year before; young children rarely make errors of this magnitude.

Activity. Time spent in monotonous work is usually overestimated. Time spent in interesting work is usually underestimated.

In one experiment two subjects were engaged in the dull task of sorting balls. At various intervals each was asked to estimate the length of time already spent. The amount of error in the estimation

was correlated with the degree of boredom reported by the subjects. The records of one subject follow (Wyatt, Fraser, and Stock, 1929).

Estimation (in Minutes) of Time Intervals
under Differing Conditions *

Actual time in minutes	Estimation when slightly bored	Estimation when greatly bored
30	25	30
50	50	55
70	75	85
90	100	110
100	110	120

Another experimenter has shown that time spent in making easy discriminations is estimated as longer than time spent in making difficult discriminations (Harton, 1938). This confirms the previous experiment, for easy work soon becomes boring. The same worker found that successful activity is judged to occupy less time than unsuccessful activity.

Groups of subjects learned mazes. Some of them were encouraged by being told how well they were doing. Others were discouraged. Those who felt successful judged the time shorter than those who felt they were failing (Harton, 1939).

Motivation. The truth of the old saying that "a watched pot never boils" has been shown experimentally.

A total of 198 subjects were divided into three equal groups and asked to write down words on pieces of paper. The members of one group were told that they could leave for the day at the end of the session. The second group worked against time with a prize going to the one who finished first. The third group, the controls, worked at the task at the beginning of a class session without any unusual instructions or incentives. After working for four minutes and thirty-seven seconds, all groups were interrupted and asked to estimate the amount of time they had been working. The estimates of both experimental groups were larger than those of the control group (Filer and Meals, 1949).

Time seems to pass more slowly when it is interposed between us and a goal we are working for.

Hypnotism. During a hypnotic trance, time can be "slowed down" by suggestion so that a few seconds of actual clock time seem to the subject like many minutes.

In one experiment the investigator used a metronome set at one beat per second and told the young women whom he had hypnotized that he was gradually slowing down the rhythm until there would be only one tick per minute. He then suggested to her that she would visit the school where she had attended the fifth grade and would be allowed to remain there for ten minutes. After she was awakened, she described the appearance of the school and her classmates and told of meeting and talking with a number of them. She could hardly believe that all this had happened in her mind in only ten seconds. In another session she was asked to pick and count cotton bolls in a field near her home. In a period of three seconds, which she thought was eighty minutes, she picked 862 bolls—an impossible feat in real life.

On another occasion, the same experimenter had a subject count 664 cows in an estimated "personal time" of thirty minutes, which by clock time was only sixty-five seconds (Cooper, 1948).

Such experiments show how important subjective experience is in the perception of time and how rapidly thought can take place. Similar phenomena occur in dreams but have been less extensively studied because of the difficulty of bringing on dreams under experimental conditions.

EXTRASENSORY PERCEPTION

A great deal of publicity has been given the problems of clairvoyance and mental telepathy. As a result, the psychologist often is asked, "Is there really such a thing as extrasensory perception?"

Extrasensory perception (or E.S.P.) is said to comprise (1) *mental telepathy*, or the passage of awareness from one mind to another without intervention of the sense organs; and (2) *clairvoyance*, or becoming aware of a physical object without using sense organs.

A typical mental telepathy test is conducted as follows: There is a deck of twenty-five

cards containing five cards for each of five symbols—star, circle, square, plus sign, and parallel wavy lines. After the cards are shuffled, one subject (the "receiver") tries to read his mind. After the receiver has called out "square," "circle," etc., his judgment is recorded as a hit or a miss. In clairvoyance experiments, the cards are shuffled and the "receiver" (there is no "sender" other than the cards themselves) attempts to record the order of the symbols in the pile of cards (Pratt *et al.*, 1940).

Thus far E.S.P. investigators have not succeeded in designing experiments which give the same or comparable results when repeated by other investigators. This has made it impossible for most scientists to recognize E.S.P. as a proved phenomenon (West, 1956; Nicol, 1956).

Certain specific errors have also contributed to scientific skepticism. One psychologist, for example, discovered that the standard E.S.P. cards could be read from the back (Kennedy, 1939). Another has shown that cues can be used by a sender without his even being aware that he is using them (Collier, 1940). If the subjects in the telepathic experiments are adequately isolated from sensory communication, on the other hand, negative results are obtained (Coover, 1917). Even when experimental conditions were controlled adequately, errors of a statistical nature have been a factor in certain E.S.P. experiments (Leuba, 1938).

Psychologists as a whole are not convinced of the reality of extrasensory phenomena.

A group of psychologists were asked in 1937 to check one of five statements to show how they stood on the matter of extrasensory perception (Warner and Clark, 1938). This survey was repeated in 1952, fifteen years later (Warner, 1952). The results of both surveys are shown in the table below.

	1937		1952	
In your opinion is extrasensory perception:	No.	Per cent	No.	Per cent
1. an established fact	5	1.5	9	2.6
2. a likely possibility	26	7.4	49	14.0
3. a remote possibility	128	36.4	136	39.0
4. an impossibility	51	14.5	36	10.3
5. merely an unknown	142	40.2	119	34.1
Total	352	100.0	349	100.0

Psychologists in 1937, though not convinced of the reality of the phenomenon of extra-sensory perception, were fairly open-minded on the subject, as shown by the fact that "merely an unknown" received the highest vote of the five alternatives. In 1952 there were some indications of a slight trend toward acceptance of E.S.P. as a valid phenomenon—the number of those who thought it an "established fact" or a "likely possibility" had risen from 9 to 16 per cent.

ACCURACY AND SPEED OF PERCEPTION

Unfortunately there is no direct method for determining whether a person's perception of a stimulus object or situation has been objective and complete. We can only infer the accuracy of his perception from the way he reacts to what he has perceived—verbally, with appropriate actions, or both. Verbal report, of course, is only one kind of reaction. Very often we react to our perceptions in actions rather than in words.

REPORTING OUR OBSERVATIONS

A group of law students sat listening attentively to the opening remarks of a lecture on legal evidence by Erle Stanley Gardner, lawyer and famous mystery writer (*Science News Letter*, 1954). Suddenly a woman burst into the room and rushed at Gardner, shouting, "You got my brother hung!" When she began to attack him with a pointed can opener, she was escorted from the room by the regular instructor, who then explained that the whole scene was a planned stunt to test the students' powers of observation. He asked the thirty-four members of the class to describe in detail the woman's clothing and appearance. Typical of the wide variation in replies was the answer to a question about her complexion. Three students said she was dark; two, ruddy; one, medium; five, fair; seven, pale; three, heavily powdered and rouged; while thirteen said they did not know. Actually, the woman had a fair complexion, was freckled, and wore no makeup. Perhaps the most conspicuous item of her clothing was an old-fashioned shoe on her

right foot—it was high-laced and had a pointed toe and high heel. It gave her a noticeable limp, since she was wearing a low-heeled shoe on her other foot. Yet twenty-five of the thirty-four students failed to mention either the outlandish shoe or the limp.

This trick is merely a dramatic example of an all too common phenomenon, the inability of witnesses to give accurate descriptions of people and events. One police chief has estimated that 50 per cent of all descriptions given to the police are inaccurate.

How do so many serious errors creep into our descriptions? Numerous factors may be responsible. Sometimes a defect in the witness' sensory equipment, such as near-sightedness, will cause errors. Or sensory data may be interpreted wrongly. If the report is not made soon after the event is observed, faulty memory may play a part in causing errors. But the greatest cause by far is *poor attention*.

Usually our perceptions are much less complete and much less accurate than the stimuli of a given situation would seem to warrant. We tend to see what we expect to see. And in unusual situations, such as an accident or a scene like that described above, we often fail to perceive the objective facts of the situation because we "don't know what to look for." We are distracted by the general excitement and fail to attend to important details. Our accuracy of observation can be improved greatly by training. Policemen are decidedly superior to the average person in ability to observe details because they know what to look for in a given situation and because they practice extensively for their tasks.

MEASURING REACTION TIME

The next time you go to a movie in which something funny or clever is said, notice when the different members of the audience begin to laugh. Some people will start to laugh long before others. If you were to measure the time that elapsed from the moment the laugh-provoking line was said until the moment when a particular person laughed, you would be measuring that person's *reaction time*.

In the psychological laboratory reaction time is measured with a high degree of accuracy in units which equal only one-thousandth of a second. This short interval of time is called a



In this apparatus used to study speed of reaction, the subject presses a key the instant he perceives the touch or sound or whatever other stimulation the experimenter is using. Automatic timing devices clock both the stimulus and the subject's response, and the interval between them is the subject's reaction time.

millisecond or a *sigma* (σ). (This should not be confused with the same symbol used to designate a *standard deviation*.) To obtain such accurate measurements, apparatus such as that pictured above is required. The typical setup for a reaction-time experiment consists of three parts: (1) a stimulus key is pressed by the experimenter to stimulate the subject and at the same time to start a clocklike mechanism going; (2) a reaction key is pressed by the subject the moment he perceives the stimulation; his pressing of the key stops the timing mechanism instantly; and (3) the accuracy of the timing mechanism is checked by a special device.

The timing mechanism, or *chronoscope*, is frequently a sort of telechron clock run by electric current, with a frequency of pulsation controlled by a tuning fork. The accuracy of the clock is checked against the time required for a ball bearing to fall a certain distance. All this complicated apparatus serves

merely to measure the amount of time elapsing between the presentation of a stimulus and the enactment of the response.

FACTORS INFLUENCING OUR SPEED OF REACTION

Much of our data about the factors influencing reaction time has come from classical studies that were conducted before modern statistical procedures had been developed. Further research is needed to validate many of these findings, but a number of generalizations appear to be pretty well established (Teichner, 1954). Among the most important of these are the following:

1. When two sense organs are stimulated simultaneously, reaction time is faster than when only one is stimulated. On the other hand, consecutive stimulation of different sense organs produces slower reaction times than repeated stimulation of the same organ.
2. In the case of visual and thermal reaction times, the more space covered by the stimulus—that is, the greater the number of receptors stimulated—the faster the reaction time will be, up to a certain limit.
3. Under good illumination, visual reaction time becomes longer as the distance of the stimulus from the eye becomes greater.
4. Speed of reaction increases with age until the individual is about thirty, after which his reactions gradually become slower.
5. In general, men have faster reaction times than women.
6. Under conditions of vigilance, when the subject must remain alert over a period of time, his reaction time becomes progressively slower as the period during which he must respond becomes longer.

Many specific factors influence speed of reaction in a given situation. Among these are the sense organs involved, the strength of the stimulus, the nature of the fore-period, the strength of motivation to respond, the amount of practice in responding, and the complexity of the reaction.)

✓ **The sense organs.** Many studies have been made of the length of time required for different sense organs to react to stimulation, but unfortunately there has not been an adequate scale for comparing the intensity of different kinds of stimuli. We cannot be sure, for example, what intensity of auditory stimulus is equivalent to a given intensity of visual

stimulus. Until we have such information our conclusions about the reaction speed of the various sense organs must be tentative.

On the basis of many experimental studies it seems fairly safe to conclude, nevertheless, that reaction time to sound is faster than to light. One very practical finding in that regard is that the reaction time in braking an automobile is slower in response to a red light than in response to a horn (Elliott and Louttit, 1938). A study of factors influencing the reaction time of airplane pilots reached a similar conclusion about the practical superiority of auditory over visual stimuli (Canfield, Comrey, and Wilson, 1949).

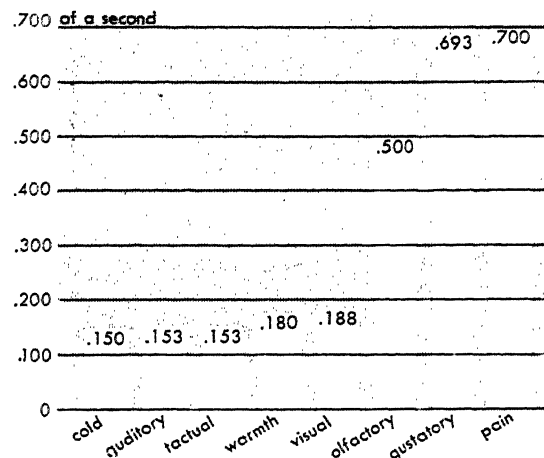
The most likely explanation as to why the eye is slower to respond than the ear is that a visual stimulus does not stimulate a nerve ending directly. When light waves enter the eye they set up a chemical reaction which *in turn* stimulates the nerve endings. This chemical reaction takes up a certain amount of time. In the case of hearing, however, the stimulation is mechanical rather than chemical—the sound waves are translated into pressure by the eardrum and the three small hinged bones (page 254). Studies of individual variations in reaction time indicate that there is a positive correlation between an individual's auditory and visual reaction times.

Individual differences in experience may affect reaction time to different stimuli. One investigator who compared tactual, visual, and auditory reaction times found, for example, that tactual reaction time was shortest in trained subjects, with auditory and visual about equal; in untrained subjects auditory reaction time was superior, with tactual about equal to visual (Lanier, 1934).

Speed of reaction to sensations of warmth varies with the area stimulated, being faster to stimulation on the back of the hand than on the palm and faster to stimulation on the abdomen than on the upper back (Wright, 1951). Surprisingly enough, reaction time to pain is the slowest of all.

Kinesthetic reaction time, as measured by a subject's speed of reaction to the sudden falling of his arm, is about the same as auditory and tactual reaction time when the response is the usual one of pressing a key (Chernikoff and Taylor, 1952). However, the same study showed that kinesthetic reaction time is the shortest of the three when the response is stopping the arm movement.

Average Reaction Times of Various Senses



Based on Boring, Langfeld, and Weld, 1948

The strength of the stimulus. The stronger the stimulus, the quicker the reaction time for all sense organs. Similar effects are obtained when we increase the stimulus duration. For each individual, however, there is an optimal duration which shows wide variation from person to person.

The nature of the fore-period. At a track meet the starter prepares the competing runners by saying, "On your marks. . . set. . ." before firing the starting gun. Careful experiments have shown that reaction times are shorter when the subject is warned that the stimulus will be forthcoming. This enables him to build up a set toward action. Because so many factors are involved, such as the duration of the warning signal and the amount and location of muscular tension produced, we cannot prescribe any one length of fore-period as best. In general the optimal range is between approximately 1.5 and 8.0 seconds (Teichner, 1954). The experienced starter varies the period of warning somewhat, thus forcing the runners to respond to the sound of the gun itself rather than to an earlier cue.

Motivation. Our speed of reaction also seems to depend on our motivation to respond.

In one experiment speed of reaction to unpleasant auditory stimuli was measured. The subjects' reactions to a stimulus of 71 decibels intensity were faster when the response served to end the stimulus than when the conditions of the experiment were such that reaction time had no effect on the stimulus duration (Chernikoff, Gregg, and Brogden, 1950).

Reaction Times for Discriminating between Colors

colors	time required to discriminate
white vs. black	.197 seconds
red vs. green	.203
red vs. blue	.212
red vs. yellow	.217
red vs. orange	
mixed with 25% red	.251
red vs. orange	
mixed with 75% red	.271

Reaction Times for Discriminating between Short Lines of Different Lengths

10 millimeters vs. 13 millimeters	.296 seconds
10 millimeters vs. 12 millimeters	.305
10 millimeters vs. 11.5 millimeters	.313
10 millimeters vs. 11 millimeters	.324
10 millimeters vs. 10.5 millimeters	.345

It is reasonable to suppose that the results of this experiment are to be accounted for, at least in part, in terms of motivation to escape a painful stimulus.

The effects of practice. The time taken to react becomes shorter with practice, largely because the subject learns to ignore distractions and to pay closer attention to his task. However, the physiological limit of improvement under given conditions is soon reached. Variability of reaction time also decreases with practice.

Complex vs. simple reactions. As we might expect, our responses to the more complex stimuli usually encountered in everyday life require more time than the very simple reactions studied in the above experiments. Studies in which the subject must make a choice before responding indicate that it takes longer to discriminate stimuli which are similar to each other than those which are clearly different. Experiments with pilots, for example, demonstrate that their reaction time varies with the complexity of the meaning they must perceive in a given situation. The average time required for the eyes to move in pursuit of a suddenly appearing target is 200 milliseconds (Travis, 1936). The time required

by pilots to fixate individual instruments when making a blind landing, however, is three times that great (Fitts, Jones, and Milton, 1950).

Other factors influencing reaction time. It is impossible to mention more than a few of the many other factors that have been studied in relation to reaction time. Alcohol lengthens both visual and auditory reaction time. There is evidence that some nutritional deficiencies may also slow up speed of reaction. When body temperature is high, reaction time is slightly more rapid (Kleitman and Jackson, 1950).

Aircraft pilots are subject to at least two special conditions which slow down their speed of reaction. One of these is low oxygen pressure at altitudes of 20,000 feet or more (McFarland, 1937). The other is a special factor known as radial acceleration, or "g." Positive radial acceleration effects are produced when a plane changes direction suddenly—as in pulling out of a dive, banking sharply, or starting to climb rapidly in an inside loop. These sudden changes decrease the amount of blood going to the brain and have the effect of slowing down reaction time to visual and auditory stimuli (Canfield, Comrey, and Wilson, 1949).

S U M M A R Y

Through our perceptual processes ^{by which} we organize and give meaning to the information we receive through our senses. Perception enables us to identify objects and situations in our environment, to determine the relationships between them, and to determine their relationships to us. Perception is partly a process of *filling in*, enabling us to interpret a series of fragments as a whole when sensory data are incomplete.

We perceive only the parts of the stimulus situation to which we give some degree of attention. *Attention* may be regarded as an adjustment of the body and its sense organs; as clearness in consciousness; and as a set toward action. It may be *involuntary*, *voluntary*, or *habitual*. Certain characteristics of the stimulus object—such as *change*, *size*, *prepotency*, and *repetitiveness*—help determine which stimuli win out over competing ones in

attracting our attention. Equally important are such subjective factors as the *organic needs* of the individual, his *interests*, and his susceptibility to *social suggestion*. Attention shifts constantly from one aspect of a situation to another. It also fluctuates involuntarily, even when the sense organs are adjusted to a particular stimulus. *Distractions* interfere with attention, although the amount of interference depends greatly upon subjective factors.

Perception usually involves *symbolic* and *affective* processes as well as *receptor* processes. It is also influenced by our *schemata*—our customary ways of perceiving, thinking, and behaving in certain kinds of situations.

Various factors operate to make us organize stimuli in a particular way. Some of these are characteristics of the stimulus object or situation—for example, the *nearness* of various elements to each other or their physical *likeness*, the *inclusiveness* of one perceptual pattern as opposed to another, and the context, or *part-whole relationships*, of a situation. The way we perceive things—particularly in ambiguous situations—also depends upon such *personal factors* as our past experiences and expectations, our organic and psychological needs, our intrapersonal and social adjustment, our age, and even our sex. In general, we perceive what we expect to perceive and would like to perceive. *Field-dependence*—inability to isolate and interpret the relevant factors in a perceptual situation—seems closely related to the individual's intrapersonal and social adjustment.

Cultural influences also play a part in determining what we perceive. Sometimes, for example, we set up *perceptual defenses* that interfere with our perception of things related to social taboos. We also respond readily to *social suggestion*, perceiving objects in the same way that others around us do.

In perceiving the *depth* and *distance* of physical objects in space, we use cues provided by the *stimulation of muscles* in and around the eye, by the *convergence* of eyes, and by *retinal disparity*. We also rely on cues from the stimulus pattern itself: *distinctness*, *linear perspective*, *texture*, *light and shadow*, *relative position*, and *known standards*. In perceiving *motion* we use cues provided by the changing relationships between various objects and, in *radial motion*, the changes in the size of the retinal image.

When a sound comes from one side or the other, the sound waves stimulate the two ears differently and thus give us cues as to the *direction of sound*. We interpret the *distance of sound* by using cues of loudness and timbre.

Time perception is influenced by our sense of the sequence of events, our memory of the past, our feeling of how long it has been since a certain event occurred, and our orientation toward the future. Accuracy of time perception increases with *age* and seems positively correlated with degree of *intelligence*. Subjective or felt time is also influenced by the kinds of *activity* in which we are involved and by our *motivation*. Subjective experience is important in the perception of time, as shown by the distortion of time under hypnosis.

Our accuracy and speed of perception are measured by our *report* of what we have perceived and by our *reaction time*. The length of time it takes us to react to any stimulus situation is influenced by the *sense organs* involved, the *strength of the stimulus*, the nature of the *fore-period*, our *motivation* to respond, the amount of *practice* we have had in responding, the *complexity* of the stimulus situation, and a number of special factors. In general, men have faster reaction times than women. Speed of reaction increases with age until about thirty, after which it decreases.

CHAPTER ELEVEN

DEFINING AND MEASURING

LEARNING

WHAT IS LEARNING?

STUDYING LEARNING

MEASURING LEARNING PERFORMANCE

CAPACITY TO LEARN

THEORIES OF LEARNING

Man lacks the precise instinctive behavior patterns found in lower animals, but his capacity for learning is much greater than theirs and pervades almost every aspect of his activity. All man's special skills, attitudes, derived motives, beliefs, and prejudices are products of the learning process—in fact, there is no single human act above the reflex level that has not been modified in some important way through learning. Learning is the core of human understanding and adjustment.

Learning is not limited to formal education. Before the young child is ever sent to school, he is already, in a sense, a "learned" creature, equipped with an extensive repertoire of behavior patterns which he has learned at home, at church, and at play. Some learning begins even before birth, and learning continues to make changes in our personality and behavior throughout life. Although it sometimes is more difficult to "teach an old dog new tricks," there is no age limit on the ability to profit from experience. Indeed, there is practically nothing we do that does not leave some stamp of learning on us.

Animals, too, can learn to adjust to certain types of situations. A dog can learn to sit up; a cat can learn to release itself from a confining puzzle box; a rat can learn to run a maze. A primitive sort of learning has even been demonstrated in the one-celled paramecium, one of the lowest forms of microscopic animal life (Gelber, 1952). Compared with that of man, however, the capacity of lower animals to learn adjustive responses is severely limited.

WHAT IS LEARNING?

Learning is popularly considered to be the same as improvement. Thus one way to tell whether a person is learning is to observe whether his responses are becoming faster, more accurate, more efficient, less fatiguing, or more useful in helping him along with people. But while learning can accomplish such desirable changes, it can also produce opposite effects. The child who is taking piano lessons can learn to play wrong notes. The stenographer can learn to spell words incorrectly. The neglected child can learn to have a "temper tantrum" in order to gain attention. Obviously, we must consider learning in more general terms, as the acquisition of either desirable or undesirable response patterns. Broadly defined, learning is a process which brings about a change in the individual's way of responding as a result of practice or other experience. Thus we would not include changes in behavior brought about either by maturation or by such special conditions as fatigue or drugs.

Psychologists assume that learning involves certain changes in the organism's central nervous system, although the nature of such changes has not as yet been identified. At best, learning has been observed only indirectly through the changes it brings in the individual's ways of responding to stimuli. When we say that a person has learned to perform a particular act, we really mean that we observe certain changes in his behavior which lead us to assume that learning has taken place.

Thus, in any experiment on learning, great care must be taken to control all variables other than learning which might produce changes in the subject's performance. For example, if an experiment is conducted to determine the effect of practice on improving reaction time, such factors as fatigue, boredom, drug stimulation, and distracting stimuli must be carefully controlled or eliminated before the results of learning can be accurately inferred from the subject's performance. When

all other factors affecting the individual's behavior have been controlled and his performance shows systematic changes which can be attributed to the effects of practice alone, we may conclude that learning has occurred.

STUDYING LEARNING

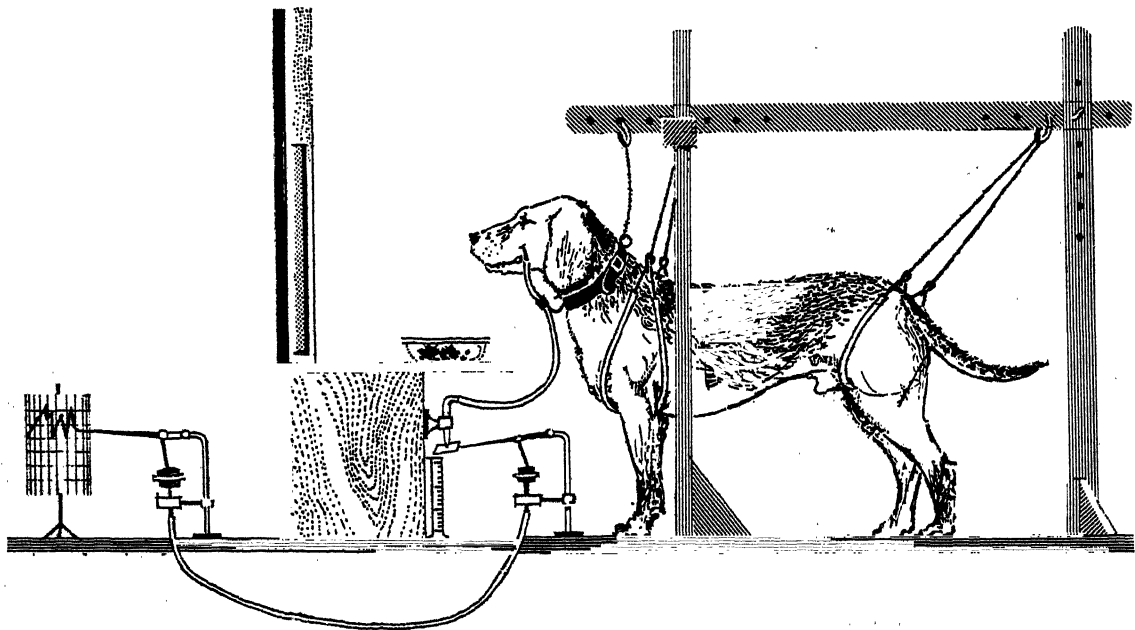
In everyday speech the word *habit* refers mainly to extensively practiced and well-established modes of response, but in psychology the term is used to refer to *all* products of learning—even to impressions which result from only one experience or which are so transitory that they rapidly fade away. It is obvious from common experience that people possess a number of different kinds of habits.

Many of the preceding chapters have been concerned with learning. We have seen how motives and interests and values are learned and how emotional and social behavior is changed through learning. We have seen how even our ways of perceiving are affected by previous learning and, in turn, help to deter-

mine what we learn from new experience. The present chapter will concentrate on the specific ways in which psychologists have tried to isolate and study the learning process itself.

Several types of experimental situations have been devised which, over the years, have become sufficiently standardized to permit psychologists working in different laboratories to compare and build on each other's findings. Whether different kinds of learning are represented in these different laboratory techniques, or whether all types of learning actually operate according to one set of principles, is a matter of debate among psychologists.

Laboratory studies of learning have centered for the most part around the following: (1) conditioning; (2) verbal learning; (3) motor learning; (4) perceptual learning; (5) attitude learning; and (6) problem solving. In the earliest experiments psychologists tried to isolate the learning process and exclude factors like thinking and emotion on the theory that such factors would distort the picture. It has been realized increasingly, however, that such factors play an important part in most human learning. Although it is difficult to study the subjective qualities of thinking and



In Pavlov's early experiments on conditioning, the dog was held in place with a harness while a dish of food was placed in front of him. A glass tube conducted the saliva from an opening in the duct of one of his salivary glands to a lever (center) which activated a stylus (far left); the stylus recorded the quantity and rate of salivary secretion on a revolving drum.

emotion by strict laboratory techniques, any complete picture of human learning must eventually include them, since they affect both the course and the quality of most of the learning we do.

CONDITIONING

Conditioning is a fundamental form of learning which underlies the development of some of the earliest response patterns in newborn infants and has even been demonstrated to occur before birth. (The experiment in Chapter 2 on fetuses learning to respond to vibratory stimuli was an example of prenatal conditioning.) Through conditioning, the organism learns to make various responses to a wide variety of stimulus situations.

Psychologists distinguish between *classical* and *instrumental* conditioning—two kinds of conditioning which occur in somewhat different situations and involve different kinds of responses in the organism.

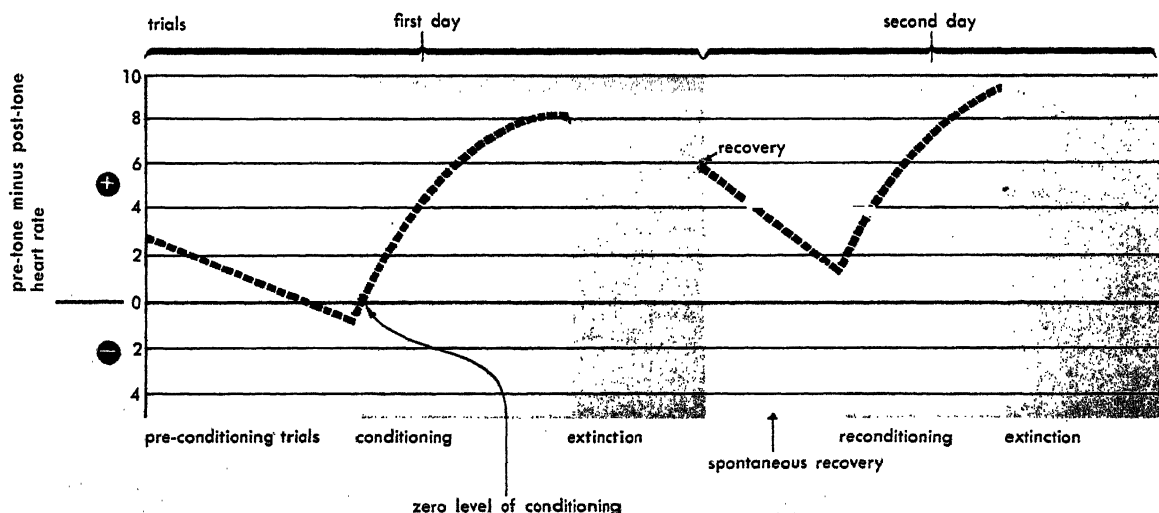
Classical conditioning. The best-known experiment in classical conditioning was performed by a Russian physiologist, Ivan Pavlov, who discovered the conditioned responses while performing a series of physiological studies on the salivary response in dogs (Pavlov, 1927). When meat powder was placed in a dog's mouth, it was observed that saliva flowed more freely than before. This automatic, inborn behavior was called an *uncon-*

ditioned reflex, and the meat powder which produced the innate response was termed the *unconditioned stimulus*. It was also noticed that when a bell was sounded in the presence of the dog there was ordinarily no change in the rate of flow of saliva. But when a bell was sounded just before the meat powder was placed in the dog's mouth, and when this procedure was repeated a number of times, the bell alone came to produce the increased flow of saliva. This change in the animal's behavior was called a *conditioned response*; the previously "neutral" stimulus (the bell) became a *conditioned stimulus*.

Pavlov's studies have had widespread influence on the development of psychological thought. The procedure of conditioning has since been demonstrated experimentally in countless studies with both animal and human subjects, and the conditioned response has become a fundamental concept in modern psychology, providing the basis for several modern theories of learning (page 318).

Another experiment made in Pavlov's laboratory was with *experimental extinction*. As long as Pavlov's dog was rewarded—that is, presented with food after salivating to the sound of the bell—his salivary response to the bell continued; but repeated soundings of the bell without *reinforcement* (reward) resulted in the gradual extinction of the conditioned response. Without such extinction training the dog might retain its habit for three or four

Classical Conditioning



Adapted from Notterman, Schoenfeld, and Bersh, 1952

months with little decrease of response, but with this technique the dog could be taught within a few days *not* to salivate to the bell.

Suppose that on a given day of training the bell is sounded twenty different times, each time without being reinforced (that is, without any food being given after it is sounded). As the bell is thus sounded trial after trial, the animal salivates less and less each time. On the last two or three such extinction trials, the dog might show no more salivation than that which occurred before conditioning. We might conclude then that experimental extinction has been accomplished. When the dog is allowed to rest for a day, however, and then is tested in the laboratory once more, we find that the conditioned response has had a *spontaneous recovery*—the dog once more salivates at the sound of the bell. But on this second day, the point of zero salivation with continued lack of reward is reached in fewer trials; and within a few more days of such work the conditioned response will have been permanently “extinguished.”

The basic phenomena involved in classical conditioning are clearly illustrated in a recent study in which a previously ineffective stimulus—a tone—came to produce a depressant effect on the heart rate through the pairing of the tone with electric shock.

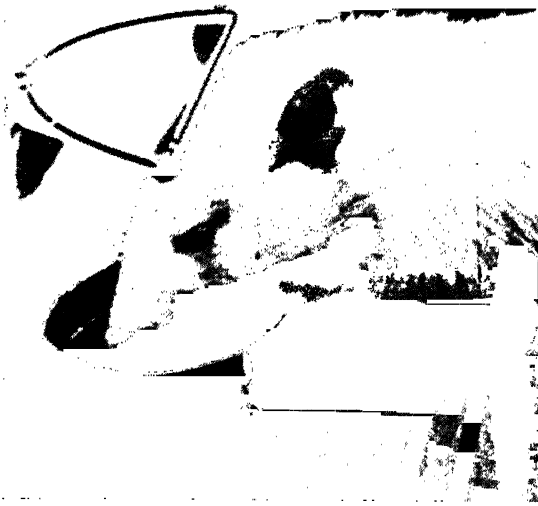
At the beginning of the experiment the subjects were given twenty preconditioning trials in which the tone alone was presented without shock. At first the subjects showed some drop in heart rate (which is a characteristic response to novel auditory stimuli), but by the end of the preconditioning trials this drop in heart rate to the sound of the tone had disappeared. Eleven conditioning trials were then given, in which a one-second tone was followed after a six-second interval by a shock. The subjects' heartbeats were recorded continuously and automatically by a cardiograph, providing a record of the differences between pre-tone and post-tone heart rates. As the graph on page 299 shows, conditioning produced a notable change in heart rate following the presentation of the tone, although there was no significant difference in pre-tone and post-tone heart rates during the preconditioning trials in which the tone was not followed by shock.

Immediately following the conditioning trials, eleven extinction trials were administered in which the tone alone was presented without the shock reinforcement. As the results show, the difference be-

tween pre-tone and post-tone heart rates gradually tended to return to the zero level, where they had been before conditioning. However, when the subjects returned on the following day, the conditioned heart response to the tone displayed a spontaneous recovery—at the sound of the tone the heart rate slowed down as it had during the conditioning trials on the previous day. Ten trials with tone alone were given, and the spontaneously recovered response again was gradually extinguished. This was followed by a series of reconditioning trials (tone with shock reinforcement), during which the conditioned response became even more pronounced than it had been the day before. The experiment was concluded with another group of extinction trials, which returned the difference between pre-tone and post-tone heart rates to the zero level (Notterman, Schoenfeld, and Bersh, 1952).

The type of behavior observed in classical conditioning is sometimes described as *elicited* behavior—that is, some recognizable physical stimulus in the organism's environment is employed to elicit a response that is already in its repertoire. Thus experiments in classical conditioning commonly employ such stimuli as electric shocks, loud sounds, and puffs of air on the body, which will produce certain physiological responses.

Instrumental conditioning. A large part of the conditioned behavior of both animals and humans appears to occur spontaneously, in the sense that it is not initiated by any recognizable external stimulus. This is not to say that such behavior cannot be attributed to some stimulus but merely that it results from unobservable stimuli such as drives and other motivating conditions. For example, when the organism becomes hungry, it begins food-seeking activity. No external stimulus, such as a dinner bell, is necessary to initiate this behavior. This is called *emitted* behavior; it too can be a product of conditioning. In this case, psychologists speak of *instrumental* conditioning, since the individual's response is considered “instrumental” in obtaining some goal-object or need-satisfaction. The emitted food-seeking behavior of the hungry organism, for example, is instrumental in obtaining food which will satisfy the hunger drive. In instrumental conditioning the response which is rewarded is reinforced, and those which are not rewarded drop out. Classical conditioning lacks this essential feature of instrumental conditioning (Skinner, 1938).



Pressing down on the stirrup-shaped lever at one end of the Skinner box causes a food pellet to drop from a spout into a food cup. At first the rat presses this lever by accident; several trials may be needed before he learns that pressing the lever brings the food. At right, Dr. Howard Hunt, at the University of Chicago, is shown placing a rat in one of a series of eight Skinner boxes.

Because instrumental responses are usually more complex than the responses observed in classical conditioning, experimental studies of instrumental conditioning have been confined mainly to animal subjects, particularly rats. The typical experiment in instrumental conditioning involves a special apparatus called the "Skinner box"—a soundproof box containing a small lever and a food receptacle. The animal is placed in the box, and when it presses down on the bar, a food pellet drops into the food tray. In more general terms, when the subject makes a response previously chosen by the experimenter as "correct," that response is immediately followed by reinforcement. Each time the animal makes the response, reinforcement occurs. As this situation is repeated, the rat presses the bar more frequently, indicating that conditioning is taking place—that the rat is learning the relationship between the conditioned response (bar-pressing) and the reinforcement (appearance of food).

Like classical conditioning, instrumental conditioning is also subject to experimental extinction. If the rat in the Skinner box presses the bar several times without receiving a food pellet, his rate of response drops toward zero. Once extinguished, an instrumental conditioned response, like the classical conditioned

response, will show a temporary spontaneous recovery when the subject is returned to the experimental situation after an interval of time.

What is the difference between instrumental and classical conditioning? Are they essentially the same, or do they involve two separate processes? Although psychologists disagree on whether any valid distinction can be drawn, it is possible at least to note that the two types of conditioning do involve somewhat different procedures. In *classical conditioning* two stimuli (the unconditioned stimulus and the conditioned stimulus) are presented together and the organism learns to make a response to the conditioned stimulus that is similar to the response already elicited by the unconditioned stimulus. In other words, the conditioning procedure tends to make the two stimuli equivalent in respect to eliciting a particular response which is already present in the organism's behavior repertoire. In *instrumental conditioning*, on the other hand, no eliciting stimuli are presented—the subject is merely placed in an experimental situation and learns to make an instrumental response which is then reinforced by reward (Brogden, 1951). Furthermore, reinforcement can take place only if the correct response occurs, which is not true of classical conditioning.

Thus, whereas classical conditioning seems to involve the formation of a relationship between two external stimuli, instrumental conditioning involves instead a relationship between a response and a reinforcing stimulus. Furthermore, whereas classical conditioning typically involves a simple, automatic response like salivating or sucking, instrumental conditioning usually involves a more complex, deliberate act. In instrumental conditioning the response itself, as well as its relation to the reward or punishment, must sometimes be learned.

Regardless of any fundamental differences that may exist between classical and instrumental conditioning, both are important forms of learning which produce changes in everyday adjustive behavior.

Distributing reinforcement. One of the most interesting findings from experiments with conditioning is that a response is apparently more "resistant" to extinction when reinforcement has been given only *periodically* rather than regularly on each conditioning trial.

In one study involving an instrumental running response, two groups of rats were each given sixteen training trials. In Group I the response was followed by reinforcement on each trial, but the animals in Group II received reinforcement on only half of the

trials. During extinction, the animals which had received regular reinforcement required an average of 15.2 trials before the criterion of extinction was reached, whereas the animals that had been reinforced only periodically required an average of 27.1 extinction trials. In other words, irregular reinforcement apparently produced a stronger conditioning than regular reinforcement, and the periodically reinforced response was more difficult to extinguish (Finger, 1942).

Other studies with both instrumental and classical conditioning have demonstrated similar results (Skinner, 1938; Humphreys, 1940; Mowrer and Jones, 1945).

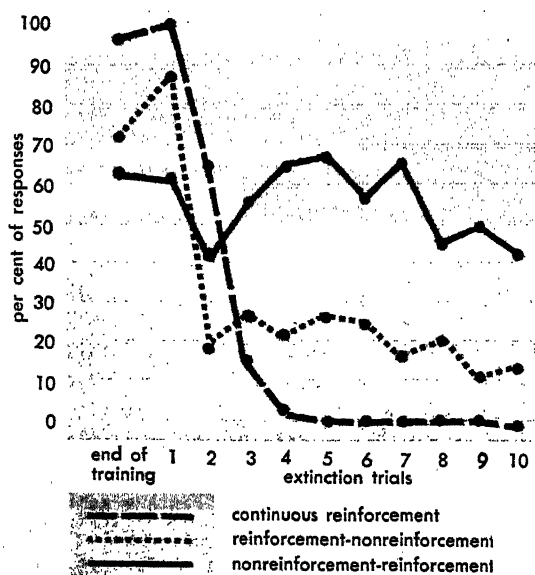
The *pattern* used in the distribution of reinforcement is also important—that is, it makes a difference whether reinforcement or nonreinforcement comes first. This was indicated in a recent study performed with college students (Grosslight, Hall, and Murnin, 1953). When nonreinforcement came first, resistance to extinction was greater.

Related to this effect of partial reinforcement is the finding that there is greater flexibility of response to a new task after continuous reinforcement than after partial reinforcement (Grosslight, Hall, and Scott, 1954).

Two groups of rats, one given partial reinforcement and the other continuous reinforcement, were trained to discriminate between white and black—white being the positive choice leading to food. After fourteen days of six trials per day, the rats had to reverse their previous pattern of response, for black now was made the positive choice. The animals which had received continuous reinforcement in the first phase of the experiment were able to reverse their pattern of choice more rapidly.

Stimulus generalization. Early in the course of his experiments Pavlov found that when a conditioned response to a specific stimulus had been learned, similar stimuli could also evoke the conditioned response. For example, a dog conditioned to one kind of bell may respond also to a bell of different tone or even to a buzzer. This phenomenon is known as *stimulus generalization* and is greater early in the training period than it is later. Generalization occurs most readily for stimuli of the same sensory mode—such as two auditory stimuli or two visual ones—but may also take place between stimuli of different modes

Effects of Reinforcement Patterns on Extinction



Adapted from Grosslight, Hall, and Murnin, 1953

(Brogden, 1951). In general there is less response to generalized stimuli as they become less similar to the original stimulus. Often *response generalization* also occurs in conditioning. Thus animals trained to press a bar with one foot will, if that foot is tied down or otherwise restrained, press the bar with another foot or perhaps with the head.

In the case of human beings it is difficult to obtain precise experimental information about stimulus generalization, but there is evidence that the phenomenon is related to age and ability to discriminate between stimuli. One recent study, for example, has indicated that the amount of stimulus generalization is greater in children aged seven to nine than in children aged ten to twelve, who are able to make finer discriminations (Mednick and Lehtinen, 1957).

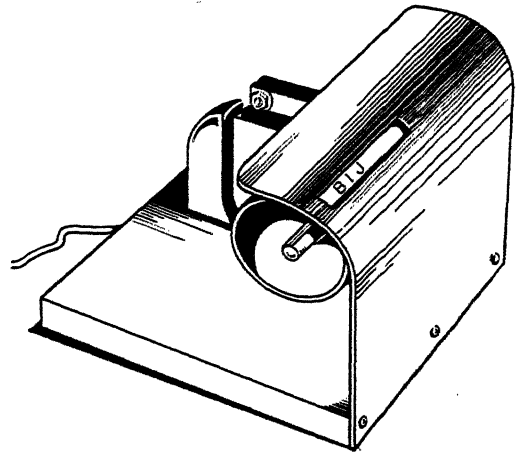
VERBAL LEARNING

It is hardly necessary to point out the importance of verbal learning in our everyday living. There are probably few things we do in the course of a day that have not been influenced strongly by previous verbal learning. Our ability to manipulate symbols, as in language, makes it possible for us to learn many things "indirectly" that the lower animals could learn only by manipulating objects, if at all.

Verbal learning, as studied in the laboratory, has typically consisted of memorizing lists of items under varying conditions. Early experiments by the German psychologist Ebbinghaus used nonsense syllables, chosen so that "pure" learning could be studied without the influence of meaning, emotional factors, or differing past experience on the part of the learners (Ebbinghaus, 1885). Experiments in verbal learning today sometimes use nonsense syllables and sometimes use meaningful material, depending on the purpose of the experiment. In the next chapter we will see some of the ways in which meaningfulness can affect what we learn and how well we remember.

The verbal learning studied in the laboratory has usually been verbatim learning. Experiments typically employ a *memory drum* such as that pictured above. In *serial learning*, the subject is shown a series of words or syllables one at a time and on successive showings must learn, as he sees each item, to

Memory Drum



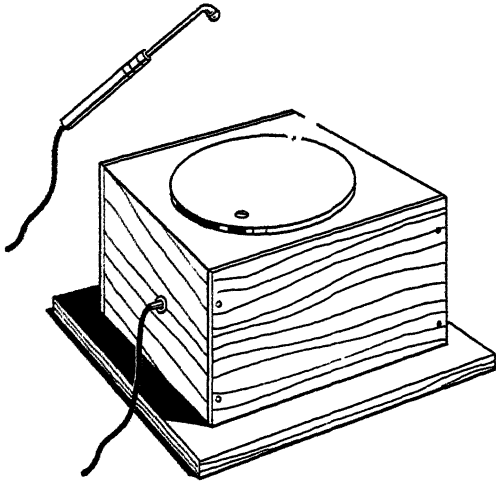
anticipate the one that is coming next. In *paired associate learning*, the lists consist of several *pairs* of items. The pairs may appear in random order, but the subject must learn to anticipate the second member of each pair when the first one appears.

The exact bearing of these experiments on the kinds of verbal learning that take place in the classroom is not yet clear. To the extent that classroom learning is memorizing of facts, the findings are directly applicable. But where other outcomes are sought—such as critical thinking, understanding of relationships, and forming valid generalizations—the application is not so clear. Yet these goals, too, involve verbal learning. Here again psychology is still too young to give us all the answers.

MOTOR LEARNING

When learning involves primarily the use of the muscles of the body, it is called *motor learning*. In learning motor habits the individual acquires new muscular coordinations as a mode of response to some situation. Learning to walk, to operate a typewriter, to swim, or to play baseball are everyday examples of motor learning. Much of our verbal behavior also depends upon motor learning, since the words which we speak are produced by contractions of muscles located in the vocal apparatus, and the hand and arm motions which we make in writing words require skilled muscular coordinations. The student

Pursuit Rotor



who has really tried to master the pronunciation of a foreign language needs no further demonstration that talking is both a motor skill and a verbal skill. Indeed, most human behavior is produced by highly complex patterns of interacting habits of different kinds. Although for purposes of clarity we may distinguish motor habits from verbal habits or perceptual habits, it is important to realize that pure examples of such habits seldom occur in real life.

The development of motor habits depends not only upon acquiring new muscular coordinations but also upon learning to utilize whatever verbal and perceptual cues may be available in the learning situation. A great deal of research has been done on the relationship of these cues to motor learning. It has been shown, for example, that visual cues are superior to verbal cues—which in turn are superior to kinesthetic ones—in learning a lever-positioning skill (Battig, 1954). Verbal instructions beforehand have been found helpful in the learning of many simple motor tasks but are of little value for complex tasks. This was noted by a recent investigator who studied performance on tasks that required the subject to press switches in various patterns (Battig, 1956). Verbal pretraining was valuable for the tasks involving the use of only one finger, but its effect decreased steadily as more fingers were involved—that is, as the complexity of the task increased.

As these experiments suggest, psychologists have studied a wide variety of motor-learning

tasks. Many early experiments dealt with such skills as telegraphic receiving or typewriting, but it has been found that simpler activities with which the subject has had little or no experience are better for laboratory study.

One of the most common is the task of tracing a star with a stylus when the star is seen only in a mirror (Hovland, 1951). As learning proceeds, the tracings become progressively smoother. Quantitative changes can be measured by plotting the number of errors made on each trial or by recording the time required to trace the star on successive trials.

An apparatus widely used in studies of motor learning is the *pursuit rotor*, illustrated at left. The subject is required to keep the point of a hinged stylus on a small brass target near the edge of a revolving turntable. His score is based upon the length of time he can do this. Because many forms of pursuit rotors are in use, there is need for more adequate standardization of such factors as target size, direction and rate of rotation, and size and shape of stylus so that all variables can be better controlled (Ammons, 1955).

As in the case of verbal learning, some motor tasks involve serial learning of a sequence of movements. In investigating these, psychologists ordinarily use various kinds of mazes.

PERCEPTUAL LEARNING

As you will remember from earlier chapters, two individuals confronted by the same stimulus situation may react differently because, as a result of past experience, they *perceive* the situation differently. One way to change a person's habits of responding is to change the ways in which he perceives his environment. A considerable amount of human learning is of this sort—the reorganization of sensory stimuli into new perceptual patterns. The ability to receive dot-and-dash code messages, for example, is primarily a perceptual habit; the telegrapher possesses a sensory organization which enables him to perceive a meaningful message in a pattern of sounds which the untrained person would regard only as a confused series of buzzes. If you glance at the figure at right, it might, on the basis of your past experience, remind you of a telephone. You might look briefly at the figure a number of times without learning to perceive it in any other way. If you stare

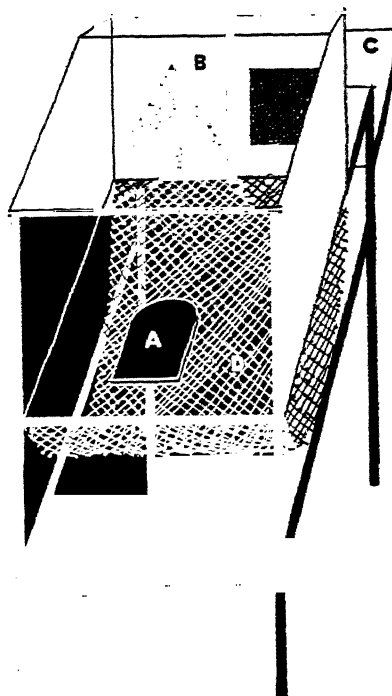
rather fixedly at the drawing, however, you will find that your perceptual processes reorganize themselves, and you will notice the profiles of two animals facing each other. As a result of this perceptual reorganization, you learn to see the drawing in a new way—you have acquired a new perceptual habit.

Much of our perceptual learning involves learning to distinguish between similar stimuli which, without discrimination training, would appear to be the same or at least would elicit the same response. In the Chinese language, for example, *shu* has a number of meanings, including "book," "uncle," "potato," and "tree." Although pronounced the same, these words are spoken with vocal inflections which are distinguishably different to the trained listener.

Discrimination has been more extensively studied with animal subjects than with human ones. A typical experiment with rats involves the use of a jumping apparatus such as that shown at right. Placed on the jumping platform, A, the rat must learn to discriminate between two stimulus cards which he sees before him, B. One of the cards—the "wrong" card—is fixed securely in place, so that if the animal jumps against it he will fall into the net below, D. But if he jumps against the "correct" card, it will fall down and admit him to a feeding platform, C. To insure that the rat is learning to make a perceptual discrimination rather than merely to jump to one side or the other, the positions of the two cards are reversed frequently.

When the two stimuli are sufficiently different, rats are able to learn to jump toward the correct card in a few trials. In general, the rate of discrimination learning becomes progressively slower as the two stimuli become more similar, until finally they are so much alike that discrimination fails entirely (Brogden, 1951). That the difference can be

Lashley Apparatus



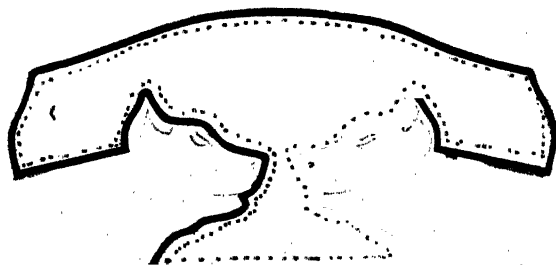
remarkably small in the case of the white rat—much smaller than previously believed—has been shown in experiments (page 306) conducted by Fields (Fields, 1954).

ATTITUDE LEARNING

Much of our learning, in and out of school, involves changes in our attitudes—our disposition to give favorable or unfavorable responses to objects, persons, situations, or abstract ideas. More specifically, an *attitude* is an emotionalized system of ideas which predisposes us to act in a certain way under certain conditions.

Just as verbal, motor, and perceptual learning occur together in varying combinations, so most experiences have an emotional component too. We learn attitudes toward school as we study mathematics or history; we learn attitudes toward tennis as we practice our forehand drive. Tendencies to be prejudiced or tolerant, selfish or generous, cooperative or antagonistic, all reflect attitudes learned through previous experiences of many kinds.

Our attitudes determine the directions in which we strive. Though our attitudes may



incorporate knowledge, they are basically emotional and may even conflict with what we know to be true or right.

Because of the importance of attitudes in motivating our behavior, we daily encounter many attempts to influence our attitudes. Church, school, and civic leaders make no secret of their efforts in this direction. Advertisers and political propagandists often try to be more subtle—to make us feel that if we change our views to agree with theirs we are only showing our excellent judgment, clear reasoning powers, practical intelligence, or other virtues. In Chapter 16 we will examine more closely some such techniques of persuasion.

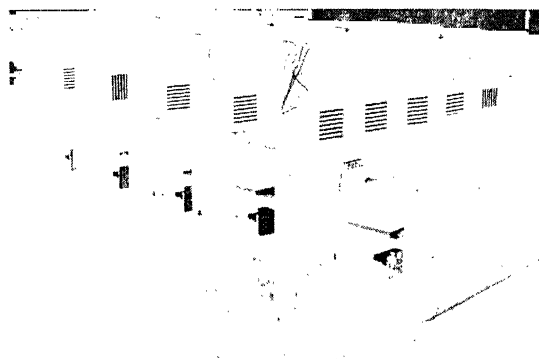
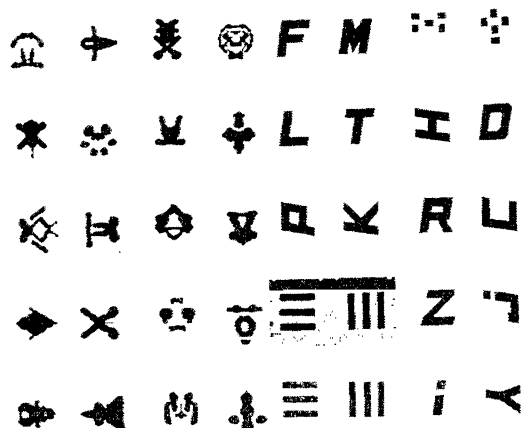
Much attitude learning takes place through identification. The little boy, for example, tends to identify with his father and learns to regard women drivers, neighbors, and Democrats in the same way that his father does. His concept of masculinity and his attitudes to-

ward being a boy are also learned in large part through his identification with his father. We strive, in other words, to be like those whom we admire and feel close to.

Recent research in group dynamics has shown that to the extent that a person feels himself a member of a group, he tends to adopt the attitudes of other group members. This is especially true if the group is a tightly knit one and the members share a strong common purpose (Sherif, 1956).

We know, too, that attitudes can be learned through simple conditioning, as shown clearly in the case of Albert (page 160), who was conditioned to fear a white rat. And often attitude learning is quite unconscious, as the following experiment illustrates:

A group of college students were treated to a series of free lunches by the experimenter. While they were eating, they listened to music, viewed unfamiliar paintings, saw photographs of college girls,



Recent experiments by Dr. Paul Fields have indicated that rats can discriminate and remember a large number of minute visual details. Above left are the designs used in one experiment. The rats were placed in an apparatus like the one above and were shown two designs and three black cards at a time, the positions being changed at random. They were able to learn which of each of the twenty pairs of designs was the "correct" one. In fact, they continued to respond correctly even when (1) the twenty pairs were given in different order; (2) each of the twenty positive cards was paired with a familiar negative card; (3) the positive cards were paired with strange cards; and (4) all three of these conditions were combined in one continuous series of twenty-five pairs. In another experiment, after being guided to an advertisement card as few as three times, a few rats were able to pick it out correctly from a panel of five. Examples of these panels are shown at left.

or looked at literary quotations or controversial political slogans projected on a screen. Later these stimuli were presented again and the subjects were then asked to give rhymes for sixteen words which could rhyme with either edible or nonedible objects—beat, boast, born, etc.—and for sixteen words which had no food-related rhymes. The subjects who had viewed the various objects while eating gave a greater percentage of food-related rhymes than did a control group who had been shown all the same objects but not while eating. When asked to unscramble words which were the names of foods, the experimental group did so significantly faster. Salivation was also increased by the presence of the conditioned stimuli. The experimenter interpreted these findings to mean that underlying attitudes toward food had been conditioned during the experiment (Razran, 1954).

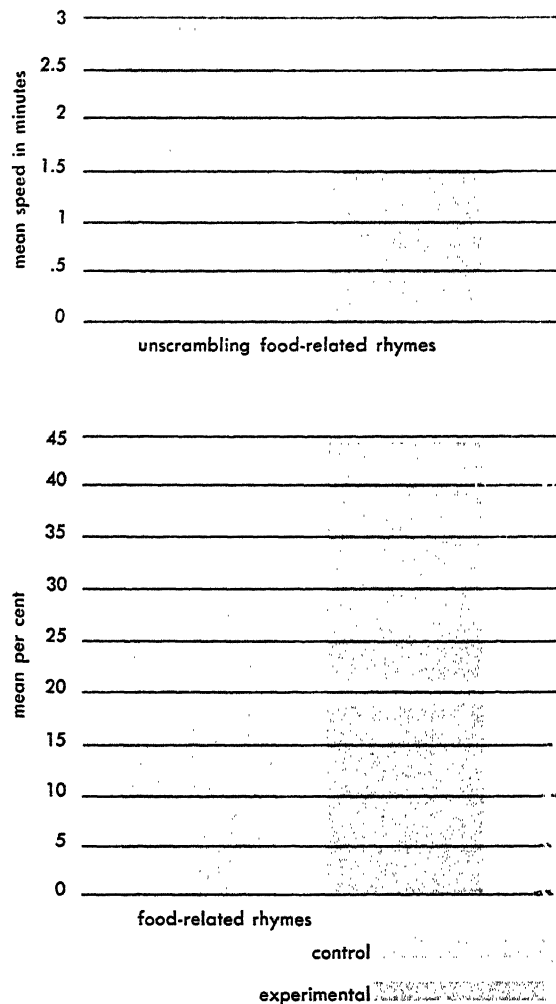
There is still much we do not know about how attitudes are learned. It is generally agreed, however, that desired attitudes cannot be taught effectively by exhortation or moral persuasion; rather, the learner must be led into an experience which itself engenders the desired emotional reaction. Such an experience—whether it has to do with a racial group or a character trait or a type of toothpaste—leaves the individual more disposed to react in the desired way.

A recent experiment illustrating this kind of learning involved changing the attitudes of college students toward Negro housing segregation.

After a preliminary measurement was made of their attitudes, the experimental subjects were given an assignment presented as a test of their ability to support a viewpoint objectively regardless of their personal viewpoint. They were to support propositions stating that if Negroes were allowed to move into white neighborhoods, certain values—such as American prestige in other countries, equal opportunities for personal development, and so forth—would be enhanced. In reporting the “objectivity test” results the experimenter presented a prepared discussion designed to make clear a number of reasonable ways in which desegregation would enhance these values.

Tests given afterward indicated that subjects who had gained insight into the relationship between housing desegregation and the various values changed their attitudes toward housing desegregation significantly. Those who were extremely prejudiced or unprejudiced to begin with learned fewer

Unconscious Conditioning of Attitudes



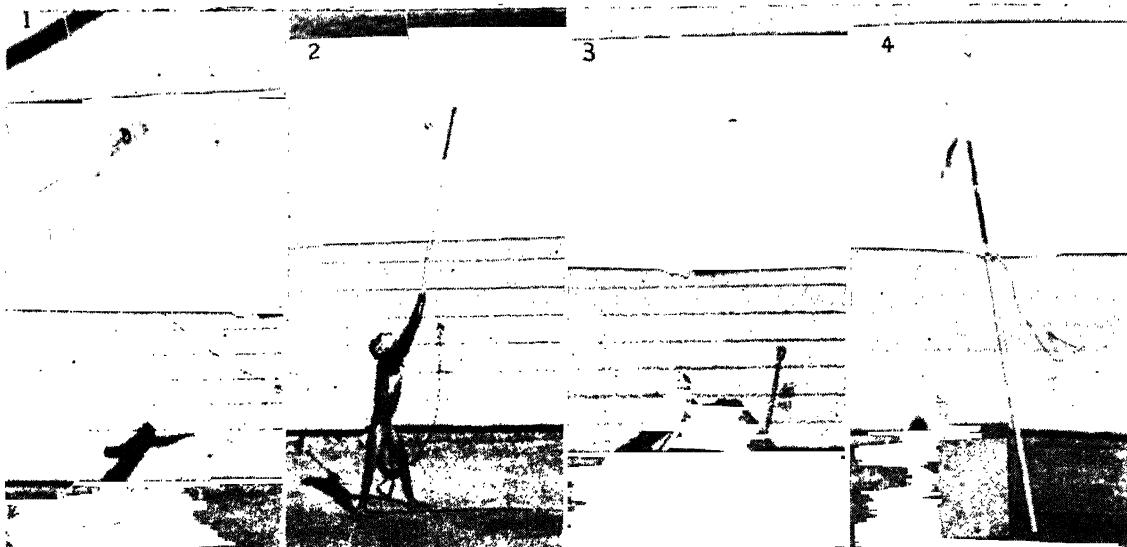
Based on Razran, 1954

new attitudes than those who began with more moderate opinions.

Attitudes on five other issues involving minority groups were also measured. On three of these the experimental group showed a shift toward more liberal views, indicating that some generalization of attitude change had occurred (Carlson, 1954).

PROBLEM SOLVING

Whenever an individual finds himself in a novel situation in which he is motivated to achieve a certain goal but in which his progress toward the goal is blocked by some obstacle which he has no ready-made response to overcome, he is confronted with a *problem*. Solution of the problem involves the development of some mode of response which will



In an experiment conducted by Dr. Harry F. Harlow at the University of Wisconsin, a monkey was faced with the problem of obtaining food placed out of his reach. After failing to get the reward by swinging from a rope, striking at it with a stick, and standing on a box which was too low, the monkey suddenly seemed to gain insight into the fact that he could obtain it by the entirely new method of climbing the pole.

eliminate the obstacle. Indeed, realistic problem solving represents the most satisfactory mode of human adjustment. Because frustration is an inevitable concomitant of living, a large part of an individual's behavior necessarily involves problem-solving activity.

Problem solving, on the one hand, utilizes the products of previous learning experiences and, on the other, is a learning experience itself. Higher mental processes may also be called into play—reasoning, forming concepts, making and testing hypotheses, and so on. Thus we will reserve our main discussion of human problem solving for a later chapter on thinking. We will limit ourselves for the present to a brief résumé of two ways in which problem solving has been studied with animals in the laboratory and of some of the concepts that have come out of this research.

Trial and error. The earliest experiments in problem solving involved putting a hungry cat into a puzzle box. Food was placed outside the box, and the problem was for the cat to learn to manipulate a latch which would open the door. During the first few trials the animal would display a great deal of varied pawing and clawing activity, pushing his nose or paws between the slats in an effort to get at the food and biting and clawing at the slats. Eventually he would press the latch, and the door would open. The experimenter

would record the amount of time the cat took to reach this solution and then place him back in the cage for another trial. On succeeding trials the escape time would slowly decrease, as superfluous movements gradually dropped out, until after fifteen or twenty trials the cat would make the correct response immediately. (Characteristically, such trial and error learning was irregular but showed a gradual course of improvement in which the extraneous responses were slowly eliminated.)

Insight. In other types of problem-solving experiments it was found that sometimes solutions came suddenly, in the absence of observable trial and error manipulation. Often there was a period during which no progress was apparent, followed by a sudden arrival at the solution. This apparently sudden appearance of the solution has been called *insight*.

In a famous series of experiments with apes, the animals were placed in problem situations where materials at hand, if properly employed, could be used in achieving a solution. The problems were to get food by the proper use of various materials placed in the cage. In one of these experiments a basket of fruit was suspended from the wire roof of the cage in such a manner that the basket could be made to swing back and forth by pulling a string. At one point of the arc described by the swinging basket was a scaffolding. The animal could catch

the basket as it swung by jumping up on this scaffolding, although he could not reach the basket from the ground. The problem was to see whether he would be able to grasp this solution.

At the beginning of one set of observations the basket was set swinging and three apes, Chica, Grande, and Tercera, were let into the cage. Grande attempted to reach the basket by jumping—a routine response—but failed. Chica had in the meantime “looked over the situation” and suddenly jumped to the scaffolding to catch the basket as it swung past. The interpretation put on this behavior is that Chica had “insight,” whereas the other animal was employing trial and error (Köhler, 1925).

Another psychologist set up similar situations with children of pre-school age. In general the children did better than the apes. Some of them used trial and error, while others seemed to “size up the situation” and then do the one right thing to get to the goal. For example, a toy would be placed far enough outside the play pen that it could not be reached. Some children would waste a considerable amount of time trying vainly to reach the toy, while others would seize a stick lying in plain sight and rake the toy in. The suddenness of the correct response and the lack of preceding trial and error were taken as signs of insight (Alpert, 1928).

The interpretation of these studies is difficult because it is not known whether the subjects had had previous experience with similar situations. If they had worked out a similar problem in the past, it is quite possible that the earlier solution was suddenly recalled and used, so that the new situation did not involve insight at all. Other experiments have indicated that in some cases of apparent insight—where new problems have been solved on the first trial—the subjects had had experience with comparable problems in the past and apparently had “learned how to learn.” Although the experimental problem had new particulars, they were able to solve it on the basis of a common principle (Harlow, 1949).

As we shall see in a later chapter, our problem solving commonly involves both insight and trial and error. Usually we start out with more insight into a problem than was possible, for example, for the cats in puzzle boxes. Thus our trial and error is not usually as blind and random as theirs. Instead, we make plausible hypotheses on the basis of what we already know from experience and then test them, either through action or by

“thinking through” the proposed solution. As we see the results of these “provisional tries,” our insight increases, and our later hypotheses come closer to meeting the requirements for solution—until at last “we have it!” Seldom do we solve a problem without trying some alternative possibilities; and achieving any solution implies, by definition, some insight into the important relationships. Even the cats in the puzzle boxes gave evidence of this



Nicholas Pastore at Queens College in New York has been investigating the ability of canaries to solve visual problems and to form concepts. In one experiment food was placed on a post too high for the canary to reach. (His wings were clipped so that he could not fly.) In order to get the food, he had to pull a toy truck along a track to a position beside the post by tugging on a string. An opaque screen was placed between the track and the canary so he could not see the truck move into place. The canary learned to match the distance with the number of tugs required to get the truck into position.

in the end, by going straight to the latch. In fact, their earlier attempts to bite through the slats or to reach between them were not completely random movements.

MEASURING LEARNING PERFORMANCE

We cannot see or measure learning directly. All we can observe and measure directly is behavior: when someone's behavior changes as a result of experience, we *infer* that learning has taken place. Even when our method of observation is introspection, we do not see the learning itself but only the results of it.

CRITERIA OF LEARNING

If we want to know whether learning has taken place, we must decide on some *criterion*—that is, some observable response which we feel cannot be made unless learning has taken place—and then work out a way to measure or rate this response. It is fairly easy to set up a criterion if the learning task is something specific like mastering a list of spelling words: we simply count the number of words the subject spells correctly after practice. It is much more difficult, however, to find a dependable and measurable criterion when we want to find out if, as a result of certain classroom experiences, children have learned to carry more responsibility, to be more cooperative, or to think more critically. Much current educational research is concerned with defining and establishing “criterion behaviors” that will give a better indication of such learning outcomes than the traditional paper and pencil tests or recitations have given.

In laboratory studies of learning psychologists have used learning situations in which a clear, easily measurable criterion of learning could be set up. Tasks have been planned in which the subjects, whether animal or human, would learn responses that could easily be scored as right or wrong. The following types of behavioral change have been the criteria most often used in these studies as indications of learning: (1) accuracy of response; (2) speed of response; (3) strength of response;

(4) probability of response; and (5) effort in response.

Accuracy of response. The person who is learning some new skill, such as typing, makes many errors in his first attempts, but with continued practice the number of errors (false movements or acts) is reduced. This indicates that learning is occurring.

Speed of response. As errors and waste movements are eliminated, the time required to make the correct response decreases. Learning is indicated either by a decrease in the amount of time required to perform a task or by an increase in the number of units of work done in a given amount of time.

Strength of response. In classical conditioning the experimenter often measures the amount of some physiological activity, such as the number of drops of saliva or the intensity of the galvanic skin response, which occurs in response to the conditioned stimulus. As conditioning advances, the measured strength of the response increases.

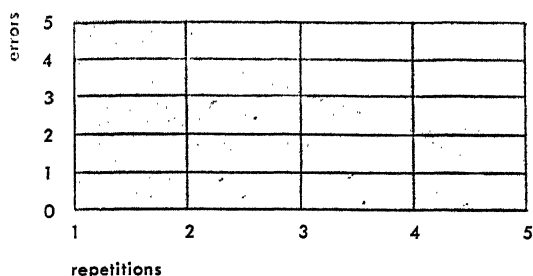
Probability of response. As learning continues, the probability increases that the subject will make the correct response rather than an unrelated one. When a group of subjects is employed, probability of response can be measured in terms of the percentage of the group who make an adequate response on each succeeding trial.

Effort in response. During the first stages of learning a complex skill we are often painfully conscious of each detail of the act to be learned. As learning progresses, we become less conscious of the details and feel less effort and strain. Because of its subjective nature, this criterion is seldom used in learning experimentation.

Objective measures, too, show that continued practice at a task results in a decrease in energy output during performance of the task. Energy cost in such studies has been gauged by the amount of carbon dioxide exhaled in the subject's breath (Becker and Olsen, 1914; Rounds, Schubert, and Poffenberger, 1932). Energy cost is not often used as an indication of learning progress, however, because of the complexity of the apparatus required to make the physiological measurement.

PLOTTING LEARNING CURVES

Whichever of these criteria he uses, the experimenter can often get a clearer picture

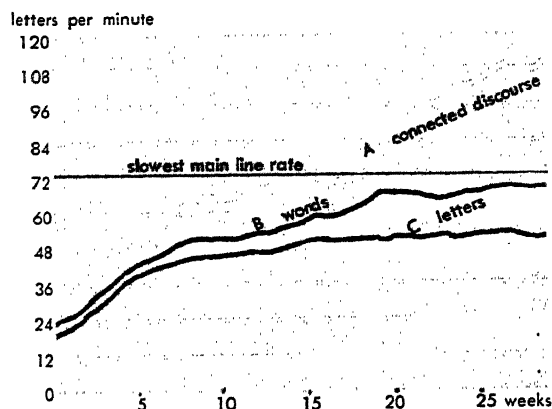


of the course of learning by plotting his data in a *learning curve*. This is a graphic device for showing the amount or quality of a subject's performance after successive units of practice. The unit of practice may be either a single trial or an interval of time—perhaps an hour of practice. In plotting a learning curve it is customary to show the units of practice as distances along the base line of the graph; the amount of performance done in a given unit is shown as a distance on the vertical axis. Either errors or correct responses may be plotted. When errors are used, the curve falls as learning proceeds and fewer errors are made; when correct responses are plotted, the curve is a rising one.

Suppose, for example, that a child makes five mistakes in repeating his 3's of the multiplication table on the first recitation. On the second recitation he makes only three mistakes; on the third, two mistakes; on the fourth, just one mistake; and on the fifth, no mistakes. Plotting the number of mistakes against the number of trials gives us the curve shown above on the left. Beside it are three curves in which correct responses instead of errors have been plotted. These were representative curves obtained in a classical study of the performance of apprentice telegraph operators learning to receive and send code. Performance in this case was tested weekly and was measured in terms of the number of letters that a student could send or receive in a one-minute period (Bryan and Harter, 1899). Observation of these three curves—which show the acquisition of perceptual-motor skills—reveals at a glance the general rate and course of the student's progress.

Notice that although the curves show a general upward trend, the student's performance also displays some variability; on some occasions his rate of performance even falls slightly. This does not mean that he has "unlearned" on these occasions; an internal or

LEARNING PERFORMANCE



external distraction or some other chance factor may have caused this drop in performance. It is important to remember that in a curve like this we have a record merely of *performance*, which may be influenced by many factors in addition to learning. Learning itself cannot be revealed directly in a graph or in a set of statistical data.

INTERPRETING LEARNING CURVES

Learning curves display a variety of shapes, depending on the skill being learned and the particular type of performance measure being employed. In interpreting learning curves, therefore, it is very important to note which particular aspect of performance is being recorded. As we have seen, a person who is successfully acquiring a new habit is likely to have a curve of *decreasing* errors and a curve of *increasing* correct responses. If he is performing more and more poorly, however, he is likely to have a curve of *increasing* energy cost and *decreasing* speed of response.

Any curve depicting the learning of an individual subject will show chance fluctuations, moving upward and downward in different parts of its course. To prevent these chance fluctuations from confusing the final picture, it is common practice to combine the results of a large number of subjects into one curve, on the theory that they would not all be distracted at the same moment or all have the same difficulty with a particular item. This is simply another case of the familiar statistical principle that, under prop-

erly controlled conditions, errors balance each other out.

In addition to determining the general *direction* of a curve, an experimenter will probably want to determine the *rate* at which performance is changing. Learning curves showing four different types of rates have been found: curves of equal returns; curves of increasing returns; curves of diminishing returns; and S-shaped curves.

Curves of equal returns. Some learning experiments yield curves of *equal returns*. These "curves" are essentially straight lines and indicate that a trial early in the experiment has yielded the same amount of improvement as one later on. Obviously, a curve of equal returns from practice could not continue indefinitely, for this would indicate that there was no limit to the effectiveness of practice and no ceiling to our learning capacity. Thus a curve of equal returns is seldom obtained in any experiment which is carried on over a large number of trials.

Curves of increasing returns. Like curves of equal returns, curves of *increasing returns* from practice have very rarely been reported by psychological investigators. Although practice may yield increasing returns over a short period, especially at the beginning of learning, the whole learning process obviously could not follow such a pattern. If the returns from practice actually continued to increase with each trial, the learning curve would soon be shooting almost straight up, indicating a still greater amount of improvement on each

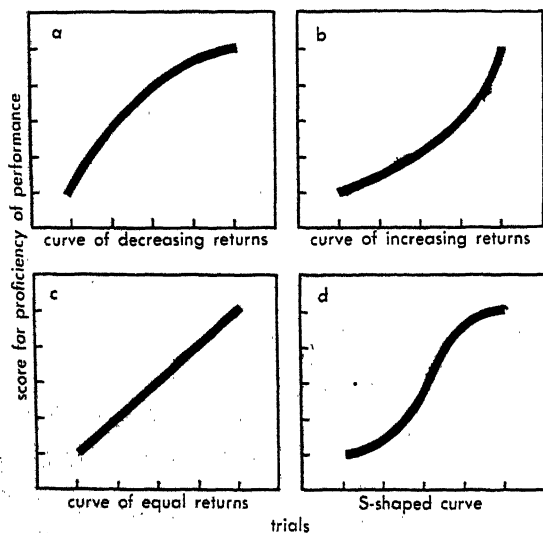
successive trial. But there is a limit to a person's learning capacity—this trend could not go on forever.

Curves of diminishing returns. Most laboratory studies of learning performance yield curves of *diminishing returns*. Such a curve indicates that the greatest amount of improvement occurs during the first few trials—that is, each trial tends to give less improvement than the one preceding. This diminishing of returns continues until a point is reached beyond which practice brings no further improvement. The curve then flattens out, indicating that the person is reaching his top level of performance.

S-shaped curves. The fact that different experimental studies yield performance curves of different shapes does not necessarily mean that there are different kinds of learning which follow different trends. A more likely explanation seems to be that different curves are found because few experiments show the *entire* learning process. In the early stages of learning a completely new and unfamiliar skill, there is a great deal of room for improvement, and a subject's performance is therefore likely to show increasing returns from practice during the first few trials. But if we study the performance of a person who is already partially familiar with the task, we are likely to find that practice yields diminishing returns, since less improvement is possible—the person who has already traveled half the distance to "perfection" has less distance to go than the person who must start at the beginning. Because it is difficult to control the factor of the subject's past experience and because there are few laboratory tasks which are not affected to some extent by transfer from previous learning, it is logical to expect that most experiments on learning performance will yield curves of diminishing returns.

If, however, we should take subjects who have had no previous experience with a task, give them material of equal difficulty throughout, and then measure their progress from beginning to end, we would expect an *S-shaped* curve. This curve incorporates all three of the curves described above. At first the learning rate increases with each trial, giving a curve of increasing returns. Then for a time the rate of learning remains constant, yielding a section of the curve which shows equal returns. Finally, there is a tapering off; less and less improvement is shown on each trial and the curve becomes one of diminishing

Performance Curves



ing returns, tending to flatten out entirely at the end. Such an S-shaped curve seems to represent the complete course of learning.

✓ **Plateaus.** Curves for some types of skills frequently have plateaus, or "flat places." Notice, for example, the curve for receiving telegraphic code, shown on page 311. The period starting around the sixteenth week of practice shows little progress. This is a typical plateau. Then, after the twenty-fourth week the learning curve shoots up rapidly, indicating that performance once again improved.

Because a plateau represents performance rather than actual learning, the occurrence of a flat place in a curve is best interpreted as indicating a period of no *apparent* improvement. Whether there is an actual arrest in the learning process itself during this period is undetermined. Three factors have been suggested to explain the appearance of plateaus:

1. A plateau may be caused by loss of interest. Under conditions of boredom, there are likely to be actual decreases rather than increases in performance with continued practice. After a short period of no practice or of a different type of activity, the subject may return to the original task with renewed vigor.
2. A plateau may be due to changing one's mode of attack on the problem. A person who is learning to type, for example, may display considerable initial improvement in performance by employing the "hunt and peck" method. In order to increase his efficiency, however, he may begin to try the "touch" method. When he first makes the transition, he may show no apparent improvement or may even appear to lose ground. Finally, however, when he acquires the higher-level habit, he forges ahead leaving the plateau behind.
3. A plateau may result from interference. Transfer from an old skill can have a negative effect on learning a new one, or parts of the same task can interfere with each other. It is well known, for example, that too much practice in reading aloud will interfere with progress in learning to read silently. The most common source of plateaus due to habit interference is "forced feeding." When the teacher or textbook introduces new skills or concepts too rapidly, the learner does not have sufficient time to gain a functional mastery of each. The result is a plateau, which will continue until the individual is able to assimilate each new habit.

Many curves show no plateaus. Their occurrence seems to depend largely upon the

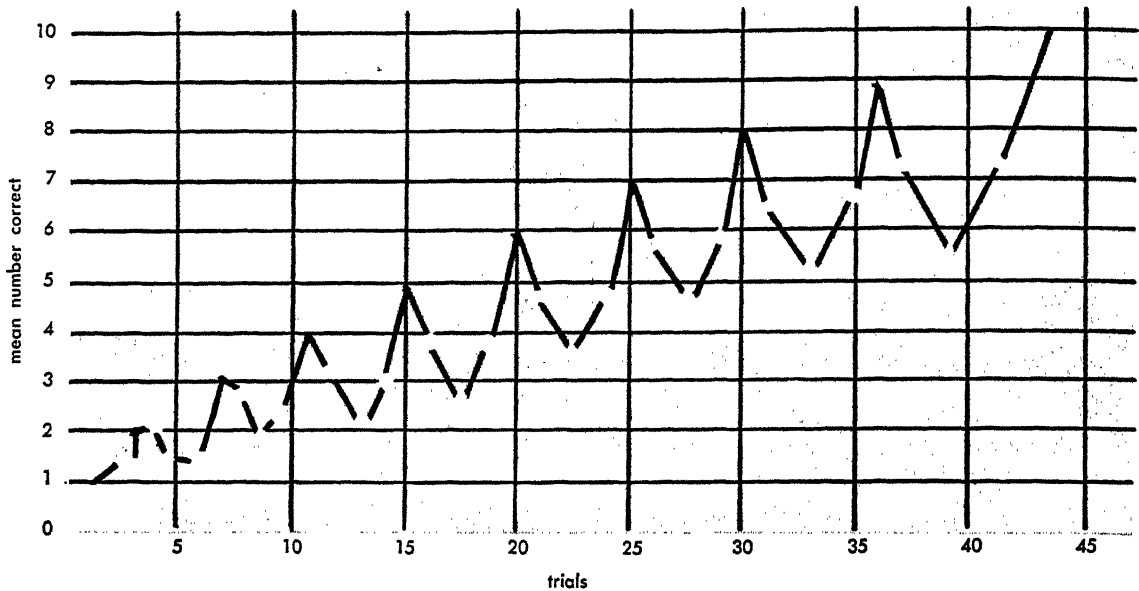
complexity of the task and the manner in which the subject approaches it, as well as on how much previous experience he has had in this activity. ✓

Cyclical curves. We have seen that learning curves based on the performance of a group of subjects tend to be smooth. This is because fluctuations in individual performance balance each other out; and therefore the smooth curve based on averages of several subjects does not necessarily mean that the individuals showed a steady improvement in performance as learning progressed. Instead, learners often show a series of oscillations, slipping back somewhat after attaining a new level of performance and then going on to a still higher level. These "ups and downs" of group learning can be shown by means of a recently devised technique known as the *cyclical curve*, illustrated on page 314 (Underwood, 1957).

This particular curve shows the results of an experiment in which one hundred subjects learned a ten-item serial list of nonsense syllables—a list so difficult that an average of 42.6 trials was required before a perfect trial was achieved. The dotted line represents the usual smooth group learning curve, made by joining a series of points representing the earliest trial at which the average subject could correctly reproduce two syllables, three syllables, four syllables, and so on to ten. This curve "skims the cream" of the subjects' performance.

The more realistic cyclical curve, represented by the solid line, indicates the oscillations that took place in learning. Like the conventional curve, the cyclical curve shows the average number of trials required to reach each successive criterion—that is, to reproduce one more syllable correctly until the final criterion of ten correct was reached. But the cyclical curve also shows, by means of solid dots, the average number of items given correctly on the trial just *before* the trial on which the subject attained each criterion. The circles indicate the average number of correct items on the trial just *after* the trial on which each criterion was attained. Still more important are the triangles, indicating the bottom of the oscillations—the average *lowest* performance shown after each successive criterion was attained. Note that the higher the criterion, the greater the drop and the longer the period of lower performance. When easier lists are used, oscillations are less extreme

Cyclical Curve



Adapted from Underwood, 1957

and often occur only between the higher criteria. It is impossible with easy lists to obtain meaningful averages on performance immediately before and after the attainment of each criterion. Thus the lowest points between criteria are the data which most clearly reveal the cyclical nature of the learning process.

In the particular study represented by the cyclical curve above, analysis of the data shows that slow learners fall farther after reaching each criterion than do fast learners. Slow learners also fall farther on the trial immediately after each criterion is attained, although they are equal to fast learners in performance immediately before each criterion.

MEASURING RETENTION

Retention and forgetting, like learning, cannot be observed directly but must be inferred from the subject's performance. In measuring the retention of a habit over a period of time, at least two measures of performance are required—the first one taken immediately after practice is terminated, the second one after an interval of time has elapsed. The difference between the two measures tells us how much has been lost during the interval. There are four methods by which we can gauge this loss—the methods of recall, recognition, rearrangement, and relearning.

Method of recall. The most widely used method of measuring retention is the method of recall, in which the subject is required to repeat some response that he has learned at an earlier time. This is the method familiar to the student who is required to repeat in an examination the material he has been assigned to study. If, for example, he has learned the capitals of the forty-eight states but on the test can remember only thirty-six of them, his recall score might be stated as 75 per cent. Such a figure, however, does not have precise mathematical significance, for we cannot say that a recall score of 50 per cent is twice as good as one of 25 per cent, or that a zero per cent recall indicates complete forgetting. Other methods of measuring retention are more sensitive indicators of memory than the method of recall, and it is often possible to detect retention by these other techniques even when recall yields a score of zero.

Method of recognition. When his retention is being measured by the method of recognition, the subject does not try to recall the items he has learned. Rather, he is given a list containing the previously learned items interspersed among many new ones and is asked to identify those that were in the original list. His score is the percentage of items he recognizes correctly, beyond the percentage he might be expected to get by chance.

eight, and seventy days, respectively. After each time interval, there was better retention of the motor habit than of the verbal habit (Leavitt and Schlosberg, 1944).

As we shall see in the next chapter, verbal material is much more subject to interference effects than are simple motor skills, a fact which explains the above findings.

DO SLOW LEARNERS REMEMBER BETTER?

We have all heard someone say, "I'm slow to learn, but I never forget." Contrary to popular opinion, however, the slow learner does not remember better than the fast learner. Although it might appear that slow learners, because they go over the simpler parts of a task so many more times, would recall them better than the fast learners, this hypothesis was not supported in a recent study.

Elementary school children learned to associate geometric figures with numbers and were then divided into groups on the basis of how fast they had learned. After twenty-four hours they were required to relearn the material. The fast group took fewer trials to relearn and made fewer errors than did the slow group (Gregory and Bunch, 1956).

There is a considerable body of data consistent with these recent findings, starting with a study published over sixty years ago (Calkins, 1894).

LEARNING CAPACITY AND AGE

Teachers, students, and parents are all interested in knowing at what age one should attempt to learn certain things in order to get maximum returns on a minimum investment of time and effort. And since social statistics show that the proportion of old people in our population is growing larger all the time, it is becoming increasingly important to investigate the extent to which older people maintain their capacity to learn.

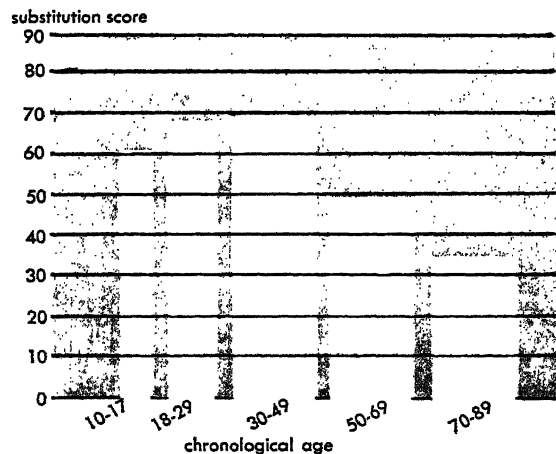
In Chapter 4 we saw some of the difficulties involved in trying to trace the course of intelligence at different ages by either the cross-sectional or the longitudinal approach. Similar problems have been encountered in trying to trace the course of capacity to learn. In general, studies with many kinds of learning tasks

have shown that the quality of learning performance increases during childhood and up to maturity, but that after this time it declines steadily in both speed and accuracy. Part of this change with age may be attributable to factors other than learning capacity. For example, during childhood and adolescence a growing background of experience undoubtedly colors the picture, and in old age it is possible that the individual's motivation decreases, as well as his physiological capacity for performing some kinds of tasks (Hovland, 1951).

The exact course of the rise and fall in learning performance seems to depend on the nature of the material to be learned.

In a specially designed series of experiments, groups of young and of old people learned two motor and three verbal tasks. One of the motor tasks was learning to perform a coordinated movement of the right hand while looking directly at it. The other motor task was learning to perform the same type of movement when the hand was seen in a mirror. Notice that in the first of these tasks the habits of a lifetime were useful—many of the basic elements of the required movement had been practiced in random fashion through daily manipulation of objects. In the second motor task, however, old visual habits would actually interfere. So before the mirror-vision habit could be set up, the old direct-vision habits had to be torn down. The results showed quite clearly that the older learners were more handicapped than the younger ones in this mirror-vision learning task.

Scores in Learning a Substitution Task, for Groups of Various Ages



The three verbal tasks showed comparable results. These three tasks were the following:

1. Associating meaningful pairs of words, such as horse-sheep.
2. Associating nonsense materials, such as $FXP=V$.
3. Associating interference materials, such as $2 \times 4 = 9$.

The subjects learned to give the second member of the pair upon seeing the first. Notice that the meaningful words can be grouped by some logical principle—both words in the example are names of animals that eat grass. But the nonsense materials are purely arbitrary— FXP could equal V or it could equal anything else. The third pair, the interference material, is so labeled because old verbal habits interfere with learning. We are so used to thinking and saying eight when we see 2×4 that it is very hard to learn to say nine.

The results showed that the young group was superior to the older one in all three tasks. The differences between the young and the old subjects were least for the meaningful pairs of words and greatest for the interference materials. Again, performance on tasks in which prior learning was an aid showed a smaller decrement with age than performance on new tasks which conflicted with older habits (Ruch, 1934).

There is no reason why older people should give up trying to learn skills and gain knowledge. Many people look forward to retirement from active business or professional life as an opportunity to pursue interests that have been neglected because of the pressure of work. In general, if the elderly person is sufficiently motivated, he will not be disappointed in his progress as long as the new skills he tries to learn are related to past abilities.

THEORIES OF LEARNING

Unless we had theoretical interpretations of the learning process, our knowledge of learning would be confined to an exhaustive series of specific "laws" describing performance under various conditions in a variety of particular learning situations. Indeed, since a subject's performance of a particular task can be measured in a number of ways, we would even have to formulate different "laws" to describe performance in terms of each different meas-

ure in the same experimental situation. The task of the learning theorist is to attempt to integrate these particular sets of isolated findings into a more comprehensive, logically coherent system of knowledge (Spence, 1952). In other words, the function of a theory of learning is to point out the logical relationships among the specific principles derived from isolated experimental situations and to combine them into a single set of generalized principles which will apply to all kinds of learning under all conditions.

Theory in any science has another function, too, in pointing up the gaps in our knowledge and suggesting hypotheses to be tested in further research. If we theorize that learning is related to drive reduction, for example, we will try to devise experiments to test this idea. The direction and methods of research always reflect theoretical assumptions made, consciously or unconsciously, by the experimenter.

Sometimes an investigator can design a "crucial experiment" to test the validity of a whole theory or a specific part of it. Too often, however, this is not possible, partly because it is difficult to control all the relevant factors and partly because in studying learning we are dealing with inferred processes rather than with processes we can observe directly. Furthermore, when such "crucial experiments" can be designed, they only support the theory being tested or prove it inadequate. They can never provide positive proof that the theory is true, because there may always be factors we do not yet know about which are responsible for the behavior we observe.

Obviously, the task of the learning theorist is not easy. The vast amount of experimental data provided by learning research consists of a great variety of findings which are often apparently contradictory and difficult to reconcile. Moreover, as we have seen, performance is influenced by many factors other than learning. To the extent that many of these factors are poorly controlled in the experiments upon which the learning theorist must base his work, his task is further complicated. Often the results of a learning experiment are ambiguous and may be interpreted in more than one way, with the result that theorists sometimes disagree radically on their interpretations of the same data.

Although the distinctions between conflicting interpretations of learning are not always

clear-cut, two major "schools" of learning theory are generally recognized—associationism and field theory. There is not perfect agreement among the advocates of either theory on all the specific issues, but in terms of their basic outlook the associationists and the field theorists offer fundamentally different explanations of the learning process.

ASSOCIATIONISM

The basic concepts of modern associationism were formulated shortly before 1900 by Edward L. Thorndike. His interpretations were based upon experimental observations of the problem-solving behavior of cats in puzzle boxes, generally regarded as the first laboratory study of animal learning. Impressed by the characteristic trial and error behavior which his cats displayed in escaping from their cages, Thorndike concluded that the basic process involved in learning is one of "stamping in" correct responses and "stamping out" incorrect responses. In this way, Thorndike maintained, the organism forms associative "bonds," or "connections," between stimulus impressions and response tendencies. This emphasis of association theorists on stimulus-response connections has earned them the popular name of "S-R" psychologists.

Although some association theorists imply that the association involves a definite connection of some sort in the organism's nervous system, most associationists define *association* simply as a working relation between a stimulus situation and a particular response—that is, they treat the process of association as an unobservable variable which intervenes between stimulus and response. As one associationist has explained:

"Our position is that what is associated is a stimulus and a response. . . . By calling them associated, we mean that the stimulation has become the occasion for the response because of a past association of the two" (Guthrie, 1942).

Observing the important function of motivation in determining an organism's performance, Thorndike proposed a *law of effect* as one of the fundamental principles of learning. According to this theoretical law, the connection which an organism forms between a stimulus situation and a response is "strengthened" when the response is followed by some

satisfaction or need reduction. In other words, when a response is followed by reinforcement, there is an increase in the tendency of the organism to repeat that response when placed in the same stimulus situation. This principle of reward, in some form, is a central concept in the theoretical systems of most associationists.

The importance of reward in learning is most prominently emphasized in the learning theory of Clark L. Hull, whose elaborate system is one of the most highly developed of modern association theories. Hull's theory is based on a structure of theorems and postulates—much like those of geometry—from which, he proposed, all the fundamental laws of learning can be deduced. According to this theory, which is strongly supported by some psychologists and severely criticized by others, the occurrence of reward, leading as it does to "drive reduction," is essential in order for learning to occur. This is a highly controversial question and represents one of the fundamental points of cleavage between Hullian associationism and field theory, on the one hand, and between Hullian associationism and Guthrie associationism, on the other. Unlike Hull, Guthrie maintains that reward is important only in that it causes the learner to be active in a certain situation and thus provides an opportunity for two events connected with that situation to become associated. Whether or not reward is necessary for learning is one of the major unsolved issues in learning theory.

FIELD THEORY

Modern field theory in psychology is an extension of the principles formulated by the Gestalt school of psychology (page 12) during the years following World War I. The term "field," as it is used in physics, refers to the gravitational or electrostatic forces surrounding an object which help determine its physical properties. For example, the speed and direction of a rolling ball are determined not only by properties inherent in the ball itself but also by the various "field forces" acting upon it. Similarly, field theory in psychology maintains that the organism exists in an environmental "field" which is constantly changing. An individual's behavior, therefore, cannot be predicted merely by analyzing his habits and response tendencies.

Any human experience has certain "field properties" which make the total experience something more than its separate elements. One melody may seem sad, for example, and another lilting and joyous; yet there is nothing sad or lilting about the individual notes played separately. These are field properties. The way we perceive a melody is determined by the interrelationships of the notes and by the way in which they interact with the listening organism. This viewpoint is based on the fundamental Gestalt doctrine that the whole of experience is more than the sum of its parts. To analyze behavior in terms of elementary associationism, the field theorists maintain, is to lose sight of the field properties affecting it.

The concept of field properties in experience and behavior is in direct conflict with the principles of associationism. Whereas the associationists analyze the learning process in terms of the formation of elementary connections between stimulus situations and response tendencies, the field theorists interpret learning as the organization or reorganization of the subject's perceptual systems into meaningful patterns. As the individual sees new meanings in a situation, his behavior changes accordingly.

In explaining how behavior changes result from the perception of new meanings in a situation, field theorists stress the role of *cognitive* ("knowing") processes. Cognitive processes have been defined as "all the means whereby the individual represents anything to himself or uses these representations as a means of guiding his behavior" (Leeper, 1951). According to this interpretation of learning, successful problem solving depends upon perceptual reorganization. In other words, a subject will arrive at the solution to a problem when he becomes aware of the important relationships involved in it. The field theorists thus explain "insight" as a form of perceptual reorganization.

Learning theory is still in an early stage of development. Much of the disagreement among rival theorists may well be resolved in time, as further experimental evidence is brought to bear on the major controversial issues (Hilgard, 1956). Indeed, the existence of basic theoretical disagreements has been a strong motivating force in making learning experimentation one of the most active areas of psychological research.

Regardless of their theoretical interpretations, all learning theorists share the same goal of producing a unified set of general principles which will explain learning behavior under all conditions. It must be remembered that a theory does not represent fact but merely interrelates facts within a logical, explanatory framework. Whatever the eventual fate of the major learning theories proposed thus far may be, the fact remains that we must rely on some theory if we are to have a systematic understanding of the unobservable phenomenon which is the learning process. (For further discussion see pages 538-544.)

S U M M A R Y

Learning is a process which brings about a change in the organism's way of responding to stimuli as a result of practice or other experience. All our responses above the reflex level are modified in some important way by learning.

Conditioning is a fundamental form of learning first investigated by Pavlov. In *classical* conditioning a neutral stimulus is paired with one which elicits a particular response that is already part of the organism's behavior repertoire. The organism learns to make the same response (called the *conditioned response*) to the previously neutral stimulus (called the *conditioned stimulus*). Whereas classical conditioning involves elicited behavior, *instrumental* conditioning involves emitted behavior. The subject is merely placed in an experimental situation and learns to make a response which is instrumental in obtaining some goal-object or some need-satisfaction. This response is then *reinforced* by reward. Unrewarded responses are dropped.

Both classical and instrumental conditioning are subject to *experimental extinction* and *spontaneous recovery*. Conditioned responses are more resistant to extinction when reinforcement is periodic rather than consistently present. In conditioning, *stimulus generalization* may occur; this means that stimuli other than the conditioned stimulus may also evoke the response. Responses, too, may be generalized.

For purposes of study, psychologists distinguish between verbal, motor, and perceptual

learning, although pure examples of verbal habits, motor habits, or perceptual habits seldom occur in real life. Most experiences also have an emotional component. An *attitude* is an emotionalized system of ideas which predisposes us to act in a certain way under certain conditions. Attitude learning may be unconscious and usually takes place through experiences which engender particular emotional reactions.

Problem solving involves developing a new response when old ones fail to achieve a goal. It relies upon previous learning but is also a learning experience itself. In solving problems, we commonly use both *insight* and *trial and error*.

Learning cannot be observed directly but must be inferred from *performance*. Psychologists use various criteria of learning—the *accuracy*, *speed*, *strength*, or *probability* of the subject's response, or the amount of subjective *effort* or physical *energy* it requires. The rate and direction of learning can be plotted on a *learning curve*, which may take one of four shapes: a curve of equal returns, of increasing returns, of diminishing returns, or an S-shaped curve. Many learning curves show *plateaus*, indicating a period of no apparent improvement. Plateaus may be caused by the subject's changing his mode of attack, by his losing interest, or by habit interference. The *cyclical curve*, a recently developed technique for plotting learning performance, is superior to the traditionally plotted learning

curve in that it shows the characteristic ups and downs of the learning process.

Like learning, *retention* and *forgetting* must be inferred from performance. They may be measured indirectly by the methods of *recall*, *recognition*, *rearrangement*, and *relearning*.

In most areas there is a *physiological limit* to the amount of learning anyone can do. Learning capacity may also vary with the specific task—there is no clear evidence of an “all-round” learning capacity. Apparently there are also different kinds of memory. Contrary to popular belief, slow learners do not remember better than fast learners.

Learning capacity is related to age and experience, increasing until the individual reaches maturity and then gradually declining. The amount of decline is related to the nature of the task, being least for tasks in which prior learning is an aid and greatest for tasks which conflict with older habits.

Learning theories integrate isolated principles into logical systems applicable to all kinds of learning. The two major “schools” of learning theory are associationism and field theory. *Associationists* emphasize stimulus-response bonds, the law of effect, and the principle of reinforcement. *Field theorists*, on the other hand, emphasize that the organism exists in a constantly changing environment in which the whole is more than the sum of its parts. They maintain that learning results from perceptual reorganization and stress the individual's use of cognitive processes.

CHAPTER TWELVE

MANAGEMENT OF LEARNING AND FORGETTING

FACTORS IN EFFECTIVE LEARNING

FACTORS IN FORGETTING

How quickly and how well we learn depends on many factors, including our own attitudes and drives, the kind of material to be learned, and the conditions under which the learning takes place. The process is complicated, too, by the fact that *past* learning can either hinder or help the learning of new material, just as *subsequent* learning can hasten or retard the rate at which we forget. In this chapter we shall consider some of the well-established facts about learning and forgetting and some of the principles which students can apply in managing their own learning. For just as some manufacturers fail because poor management pushes up their costs, so some students fail because they do not organize and manage their learning effort well.

FACTORS IN EFFECTIVE LEARNING

Careful research over the past several decades has identified a number of factors which influence the course and quality of our learning. Some of these factors are related to characteristics of the "subject matter" or of the external situation in which learning takes place. Others are characteristics of the learner himself and what he brings to the learning situation. Some of the latter, such as inherent capacity, are beyond the individual's control and so will not be discussed in this chapter. Here we shall consider only those factors which are at least potentially within the control of the learner himself or of those guiding his learning.

INFLUENCE OF MOTIVATION ON LEARNING

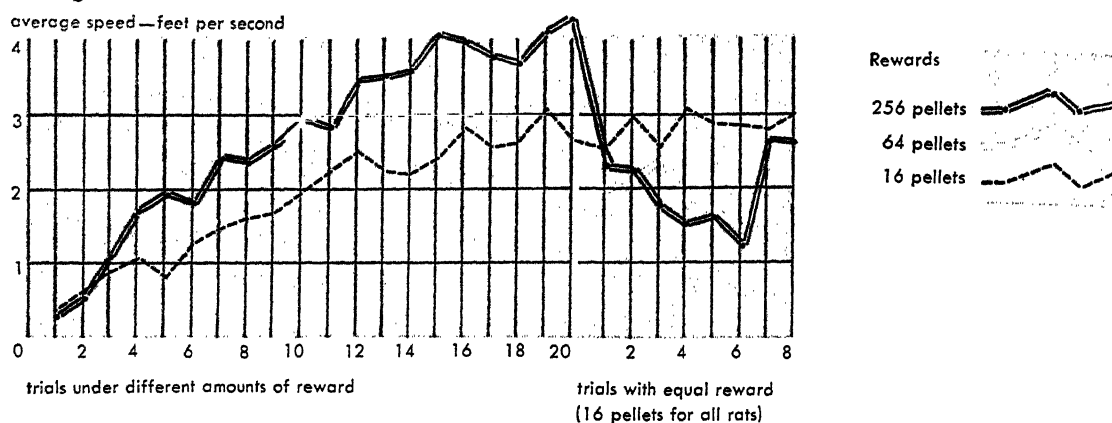
The relationship between learning and motivation has been investigated extensively in the case of animals but less well in that of human beings because of the greater difficulty of establishing experimental control. We have never been able to arrange conditions so that the

subject is still awake but not motivated in any way. It is possible, however, to approach this condition and to observe how the quality of performance decreases as the strength of motivation decreases. Indeed, speed of learning is frequently employed as a criterion of the strength of motivation.

Intent to learn. One of the most important motivational factors influencing the learning performance of human subjects is the presence of a conscious intent to learn. The significance of this factor was demonstrated in some of the earliest studies of human learning.

In one early experiment subjects were instructed to count the number of "O's" distributed among letters printed in color on colored paper. Later the subjects were asked questions about what other letters were present, what color they were, and on what color of paper they were printed. Their inaccurate answers showed that little if any learning had occurred with regard to the material to which they had been exposed without instructions to learn. In other words, the subjects learned only that mate-

Learning vs. Performance



Performance is not always an accurate indication of learning. In one study, three groups of rats were trained to run down a pathway to get food pellets in the end-box. Rats in one group received 16 pellets; in another, 64; in the third, 256. Speed of running was found to be proportional to the size of the reward, as indicated on the graph above. The difference, of course, could have been due either to different expectations or to a stronger habit established mechanically where the reward was higher. That the former was the case is indicated by the fact that when, on the twentieth trial, all rats began to receive 16 pellets as reward, the performance of all three groups began to change markedly, as shown in the graph. A few trials later, their relative positions were exactly reversed.

rial which they consciously intended to learn (Myers, 1913).

In a more recent and more systematic study of this problem it was found that the nature and amount of learning are definitely affected by the nature of the instructions given the subjects. The experimenters found that when no specific instructions were given, only a general comprehension of the material was attained; but when the subjects were given specific instructions about what to learn, the learning itself became specific to those instructions (Postman and Senders, 1946).

Experiments of this nature are complicated by the fact that instructions can come from the experimenter or they can be self-imposed by the subjects. In the latter case, the subjects may learn certain incidental aspects of the material which are not directly related to the task assigned by the experimenter. In one study, for example, in which the experimenter gave subjects material to read but did not instruct them to learn, some of the subjects reported deliberate and consistent self-instruction to learn (Jenkins, 1933). Thus, when we find incidental learning in the absence of specific instruction, we must always consider the possibility that the subjects instructed *themselves* and so possessed conscious intent to learn.

Modern teachers in schools and trainers in industry take great pains to increase the learner's intent to learn before presenting the subject matter itself.

Reward and punishment. Experimental studies have shown that the strength and nature of rewards or punishments administered by a teacher or experimenter influence the learner's rate of learning, as measured by his subsequent performance. The learner's own evaluation of his progress can also be an important factor.

In one study it was found that children learned arithmetic more rapidly if they were publicly praised but more slowly if they were reprovved or ignored (Hurlock, 1925).

A somewhat similar experiment conducted with college students as subjects showed that they, too, like younger school children, respond better to encouragement than to discouragement. In this experiment the subjects were tested for their performance on a certain task. Each person was then retested on the same task. Just before they took the second test, some of the subjects were encouraged by the experimenter with words such as: "That is really splendid! Do you always make such good scores? . . . Your score is so good that I wonder if you would mind repeating the test." Another group of

subjects was discouraged with remarks such as: "Oh, dear, that is really a very poor score," etc. A third group was neither encouraged nor discouraged. Actually the scores in all three groups were comparable. This same procedure was later followed with the same subjects on another task. As shown in the table below, encouragement was superior to discouragement in getting subjects to excel their previous performance (Gates and Rissland, 1923).

Effects of Encouragement and Discouragement on Later Performance

	Per cent improving	Per cent falling off	Per cent remaining the same
coordination task			
encouraged	89	11	0
discouraged	70	26	4
neither	64	28	8
color-naming task			
encouraged	58	38	4
discouraged	51	40	9
neither	44	48	8

It is interesting to note that among the subjects who were told that they had not done well on the first trial, those who had actually made the poorest performances were most sensitive to discouragement. This is one reason why teachers in many modern schools hesitate to mark a child as failing.

Another experiment on the effect of encouragement and discouragement is of considerable significance because it shows that praise or censure for one type of performance may spread its influence to other unrelated performances.

Twenty college students were divided into two equal groups on the basis of their demonstrated ability to sort playing cards and to learn to repeat short lists of meaningless words. Each subject was paired with another one of exactly equal ability as shown by pretests. Each subject was then given fifteen trials at card sorting on each of three days. The card sorting on each day was preceded and followed by the learning of a list of ten nonsense syllables. The subjects of one of the two groups were discouraged by false statements to the effect that their card sorting was decidedly below par; the other group were encouraged by similarly false statements to the effect that their sorting was excellent. *Nothing was said about the quality of their learning on the word lists.*

The card sorting of the discouraged students became progressively worse throughout the course of the three-day experiment. The praised ones worked harder and continued to improve at the sorting task. But what about the subjects' performance in learning nonsense syllables, a task in which they were neither encouraged or discouraged, falsely or honestly? It is striking that those subjects who were discouraged about their card sorting showed a similar falling off in their ability to learn nonsense syllables. On the other hand, the subjects whose performance in the sorting task had been praised showed improvement in the word task as well. Apparently the effects of encouragement or discouragement had generalized (Sears, 1936).

Numerous experiments conducted with various creatures ranging all the way from earthworms and cockroaches to human beings have shown that punishment can be an aid in eliminating undesirable behavior or performance errors. The use of punishment has many disadvantages, however, and its effect is temporary at best.

This has been indicated in a study conducted with rats in Skinner boxes. As we have seen, the Skinner box is a device in which the animal presses a bar to obtain food. After a number of rats had achieved equal proficiency in pressing the bar, they were divided into three groups. The rats in Group A were neither rewarded with food nor punished with shock; those in Group B were not rewarded but were punished periodically; and those in Group C were punished regularly every time they pressed the bar. On the day the punishment was administered, the regularly punished group, C, made fewer responses than the others, whereas the unrewarded group, A, made nearly as many as before. Group B made more responses than C but fewer than A. However, after a period during which none of the rats had an opportunity to press the bar, Group C made the most bar-pressing responses and Group B the fewest. Lack of reward alone (as experienced by Group A) had done more to break the bar-pressing habit than had regular punishment (Estes, 1944).

Punishment may actually prevent effective learning. For example, even though the regularly punished rats in Group C refrained temporarily from bar-pressing, they did not learn that bar-pressing would not be rewarded. In the same way, a child punished for temper tantrums may temporarily cease to have them but will not learn permanently that tantrums are

an ineffective way to obtain his goals. Severe or prolonged punishment may even frustrate an individual so much that it will block all efforts to learn. Or it may spread to activities other than the one it was designed to correct and result in a general attitude of negativism and resistance.

Reward has more predictable results than punishment. "Reward says: Repeat what you have done. Punishment says: Stop it! But the punishment does not tell what to do, and the result may be simply emotional upset." (Hilgard and Russell, 1950).

Punishment aids learning most effectively when it is used in combination with reward. If the undesirable response is suppressed because of punishment, the subject may make some alternative, more desirable response which can then be reinforced by reward (Commins and Fagin, 1954). In this way reward and punishment may set up cues as to what is good and what is bad—something that punishment cannot do alone. It should be kept in mind that, to be effective, punishment must be given in such a way that the learner knows clearly what specific response is being punished.

Extrinsic and intrinsic motivation. Laboratory studies of learning usually have depended on what is called *extrinsic* motivation—motives such as hunger, thirst, or escape from electric shock—which can motivate the subject to action but which have no inherent relationship to the task to be learned. This has been necessary with animal subjects to assure that they would be active enough to make the responses that were to be learned. It also has the positive advantage of enabling the experimenter to "control" the factor of motivation—to know what motives are acting and to control the degree of motivation for all subjects.

With human learning studies, the problem is more complex. The experimenter usually does not have the same control over his subjects' physiological needs, and he can never know how far learning performance is being affected by motivational factors he cannot see—such as self-instruction, a need to excel, or a high level of aspiration. This is a further reason why so much work has been done with animal subjects.

Report cards, honor rolls, and gold stars are examples of extrinsic motivation used in the schoolroom. It has been found, however, that such devices motivate some children more

strongly than others and that both learning and remembering tend to be better when the motivation is *intrinsic*—when the pupil is interested in the learning task and anxious to learn it for its own sake. Thus today's teachers rely less on rewards and punishments and try instead to build interest in the material to be studied. When learners feel the *need* to know and are active in searching for information, they understand and remember what they learn better than when the same material is simply presented to them to memorize.

In everyday learning situations both intrinsic and extrinsic motivation often are involved. Learning may be sought for its own sake and also as a means to a further goal. The Boy Scout is eager to learn Morse code so that he can exchange secrets with his pals but also so that he can advance his scouting rank and win the acclaim that goes with it. Similarly, the scientist does research "to find out" but also to gain recognition and advancement.

Long-term goals and interests. Learning and performance are influenced not only by the learner's goals of the moment but also by his long-range goals and interests. Students usually do better, for example, in elective courses—in which they are presumably more interested—than in courses they are required to take (Crawford, 1929). Compare with several friends what you remember from some speech or program which you have all heard. You will be impressed at how each person's interests and values have affected what he has learned from this common experience.

Certain information is useful to nearly everyone, regardless of his immediate personal goals. For instance, the material in psychology which relates to personality adjustment is far more interesting to most students than less personal material. But the student who can become interested in material which is not directly related to himself and his immediate problems is the student who finds learning most rewarding. Other things being equal, the student who has broad interests will probably learn better than the one whose interests are narrow.

Influence of stress. When an individual is motivated to achieve a certain level of proficiency in performing a task, failure or threat of failure produces stress. Working under the pressure of time or under conditions of distraction also induces stress in the learner. We have already seen the results of one experi-

ment in which stress was induced by telling subjects they had done poorly—their later performances tended to become worse. However, individual differences are apparently important in determining just how stress influences performance.

A large group of college students were told that they were to take an intelligence test which was an excellent predictor of college success and that the results would influence their status in school. The subjects were then administered the digit-symbol subtest, a *learning* task, from the Wechsler-Bellevue intelligence scale. After the test the papers were collected, presumably for correction. An hour and a half later, the names of part of the group were read off, and instructions were given for them to report to another room. The students remaining in the original room (who were matched with the others as to grade-point average) were then told that they had done very poorly on the intelligence test, whereas the other group had done satisfactorily. It was explained that failure was a serious affair and that they would be given another chance to make the results certain. Following this stern warning, which presumably placed the individuals in this group under stress, the subjects were given an alternate form of the same test. At intervals during the test the experimenter further increased stress by calling out false norms which were beyond the ability of the students to achieve. For example, he would say, "You should have finished line B," at a time when the students could not yet have finished that much of the test.

Meanwhile, the subjects in the other group were also given the alternate form of the test. But they were told that they had performed well on the first test and that they were to take the second test to be sure that their true ability had been measured. They were urged to improve their performance if possible, since their final score would be the average of the two testings. These subjects were also interrupted by the experimenter's calling out norms, but the norms in this case were within their level of performance.

Surprisingly enough, the average number of correct substitutions on the second test was the same for both groups. The group under stress, however, made a greater number of total substitutions. It showed an increase in speed of performance as compared to the nonstress group, but this increase in speed occurred at the expense of accuracy.

The most interesting result of this study was that it showed considerable individual differences in level of performance under stress. The members of the

stress group obtained scores over a much wider range on both sides of the average than was true of the nonstress subjects, whose scores were bunched more closely together. Under stress some individuals did better and others did worse (Lazarus and Eriksen, 1952).

That frustration increases the length of time required for learning, partly because it increases stereotyped behavior, was shown in an experiment performed on 144 subjects.

Each subject was asked to learn a pattern of responses. He was seated before a screen on which a red light flashed every five seconds as a signal for him to press one of two keys. If he pressed the "correct" key, a white light flashed; if he pressed the "wrong" one, a buzzer sounded. The keys were attached to a hidden recording mechanism which made a written record of the amount of pressure exerted, as a measure of the subject's vacillation.

The subjects, young men and women of similar socio-economic background, were divided at random into six groups. One group was given five tries at a problem which could not be solved—that is, the white light and the buzzer were used haphazardly rather than according to any predetermined pattern of correct responses. Members of this group were given a strong incentive by being told that performance in learning patterns such as these was a good test of intelligence and that they should be able to solve the problem in two minutes. The second group was given five trials on a nonincentive basis, being told that the experimenter was using them merely as a sample group in order to find out how difficult the problem was. The other groups comprised an incentive and a nonincentive group who were given fifty trials at insoluble problems and an incentive and a nonincentive group who had one hundred trials. After these frustrating attempts were completed, all groups were allowed to master patterns which could really be learned.

There was a highly significant difference between the mildly frustrated subjects and those who had been subjected to fifty or one hundred impossible tasks in the amount of time required to learn these patterns. The difference between the fifty and the one hundred groups was slight, however, indicating that after a certain point further frustration has little effect on learning time. The incentive groups learned the new material somewhat more slowly than did the nonincentive groups.

If a subject struck the same key more than six times consecutively, his response was regarded as stereotyped. Between the five group and the fifty

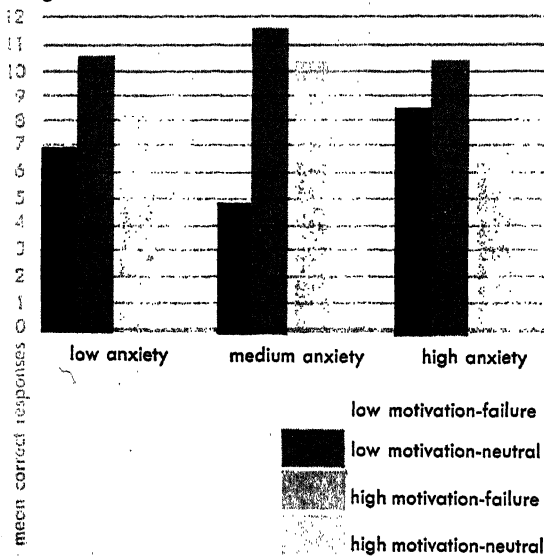
and one hundred groups there were highly significant differences both in the duration of stereotyped responses and in the proportion of stereotyped responses to the total number of responses. However, the one hundred group had slightly fewer stereotyped responses than the fifty group.

Only about 41 per cent of the subjects showed vacillation, but those who did passed through an initial steady period with little vacillation, an intermediate period with fairly marked vacillation, and a concluding period, in which vacillation fell to zero. Vacillation decreased during stereotyped responses, indicating that stereotypy provided some degree of adjustment to frustration. Reports given by the subjects indicated that most of them felt disturbed and hostile, but none realized that the frustrating problems were insoluble. Most of them were quite unaware that they had shown stereotyped responses (Jones, 1954).

The dynamics of stress involve a complex relation between strength of motivation and degree of frustration, and the influence of stress upon an individual's performance depends largely on the structure of his personality.

An anxious individual tends to regard as threatening many situations which would be neutral to a person with less anxiety. Anxiety reduces the individual's ability to discriminate clearly.

Effects of Anxiety, Failure, and High and Low Motivation



Based on Sarason, 1956

In one study subjects were tested for anxiety before taking part in eyelid-conditioning experiments. The anxious subjects tended to regard the negative stimuli as just as threatening as the positive stimuli, although only the latter were followed by an air puff to the eye. This was shown by the fact that they tended to blink in response to negative as well as positive stimuli more often than did nonanxious subjects (Hilgard, Jones, and Kaplan, 1951).

Another recent study shows the relation between general anxiety level and learning performance under strong motivation.

In this experiment each group of subjects contained an equal number of individuals who had shown high, low, and medium anxiety on the Taylor Anxiety Scale. Part of the groups were told that the experimenter was merely determining the characteristics of the lists of nonsense syllables which were to be learned and that the subjects' performance did not matter. The rest were highly motivated by being told that the task was a short-form intelligence test. They were urged to pay close attention to each syllable. The test results revealed that the high motivational instructions made the low and middle anxiety groups learn faster but were detrimental to the high anxiety subjects. This interaction between anxiety and motivation was still significant twenty-four hours later and on a relearning test given a month later.

During the original tests, part of the subjects in each group were told they were failing and were getting scores below normal college level. Immediately after being told this, the "failed" subjects at all three levels of anxiety gave significantly poorer performances than the others; after twenty-four hours, however, the effects of failure had disappeared (Sarason, 1956).

The results of these experiments show that stress affects the performance of individual subjects in different ways. In some cases the threat of failure seems to operate as a strong motivating force to work for success, thereby facilitating performance. In other cases, however, the emotional components of stress seem to be so disturbing that they disrupt performance by producing mental "blocks" or severe anxiety reactions which distract the person from his task.

Group participation and learning. An important factor in motivation to learn is the cooperative attitude which comes from group par-

ticipation. Whereas it is relatively easy to teach people facts and principles and theories through such methods as reading and lectures, experience has shown that it is much more difficult to teach people to behave in a new way. A recent experiment supports the conclusion that group participation and group decision are highly effective methods for producing behavior change.

The problem involved in this study was to get industrial supervisors to rate their workers accurately on a rating form. The goal was to correct the tendency of supervisors to rate the more highly skilled and more highly paid workers higher in performance than those of lower skill and pay. This tendency conflicted with the purpose of the rating procedure, which was to rate each worker according to his performance of his particular job. The subjects in the experiment were twenty-nine supervisors who had been rating workers for years.

Group A, consisting of nine supervisors, served as a control group and received no special instructions for improving their rating techniques. Group B (eleven supervisors) was instructed through group discussion. Several days prior to a scheduled rating, the members of this group were brought together around a table with a discussion leader. The leader did not sit at the head of the table, nor did he direct the discussion in detail. He showed the supervisors in Group B a graph showing that workers in the higher wage and skill brackets were consistently rated as higher in performance than those in the lower brackets and then raised the general question of why that should be. From that point on he acted only as moderator and avoided injecting himself into the discussion. All decisions were made by the group. At the end of an hour and a half the group had decided that the best way to avoid inequalities in the ratings was to disregard the difficulty of the job and to rate each man on his performance of that job.

Group C, composed of nine supervisors, was instructed through the lecture method. They gathered in a lecture room with all members of the group facing the leader. The errors in their previous ratings were carefully pointed out and much background material on the theory and practice of ratings was presented in an authoritative manner. At the end of the meeting the leader explained what each rater was supposed to do: he was to rate individual performance and not difficulty of job.

When the results of the next rating were examined it was found that only Group B, which participated

in the nondirective group-decision learning situation, had significantly changed their ratings to conform to the proper procedure (Levine and Butler, 1952).

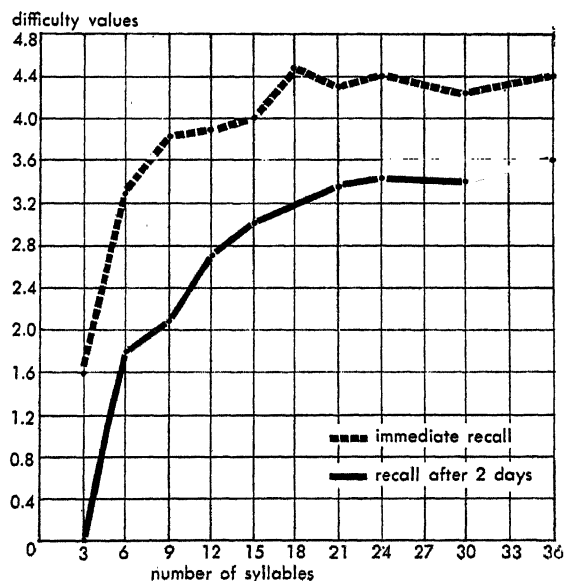
Group participation is obviously a strong dynamic factor in learning.

CHARACTERISTICS OF MATERIAL TO BE LEARNED

It is common experience that we learn some things more easily than others. Sometimes this is explained by motivational factors, as we have just seen, or by other conditions in the learning situation. Equally important in most instances is the nature of the material to be learned—its amount, its familiarity, its meaningfulness.

Amount. A verbal learning task so brief that the subject can master it in a single presentation is said to lie within his *memory span*. College students usually have a memory span of between six and eight units (such as digits or letters) if the material is presented orally, but they can seldom repeat a list of more than nine or ten items following a single presentation. You will notice that telephone numbers, even in a large city exchange, do not exceed seven letters and digits.

Experience with memory span items has indicated that in about nine cases out of ten, adults who cannot repeat five digits forward or three backwards will be found to be feeble-



minded (Wechsler, 1944). Memory span for nonsense syllables is about the same as for digits, but for meaningful material, such as words and sentences, the span is higher.

With increased amounts of material, there is an increase not only in the total length of time required for learning but also in the average amount of time required for each unit of material learned. For example, a person who is able to learn a list of seven nonsense syllables in a single presentation might require three or four repetitions to learn a nine-syllable list and nine or ten trials to learn ten syllables. As the curve on page 329 indicates, however, the rise in difficulty of nonsense syllable lists begins to level off when the list is about twice as long as the memory span (Shurrager, 1940). Beyond that point increased length of material adds little to its difficulty, unless the list is lengthened considerably. For short lists, in other words, increase in difficulty is disproportionately faster than increase in length; for very long lists, increase in difficulty is disproportionately slower.

Similar results have been obtained for meaningful material (such as prose and poetry) although increased learning time with increased length is considerably less striking here than with nonsense material. Similarly, it has been shown that where the learner has only to master the essential ideas of a passage rather than learn the material verbatim, increased length has a comparatively small effect on learning difficulty (Cofer, 1941).

Familiarity. Learning is facilitated by the mere fact of prior familiarity with the materials even in the absence of specific set to learn. This has been demonstrated in the laboratory as well as by everyday experience.

In a recent study with rats one group was raised in cages with black circles and triangles on the walls. A control group was raised in cages with plain white walls. When both groups learned a circle-triangle discrimination, the rats who had had experience with the two geometric forms learned faster and made fewer errors than did the controls (Gibson and Walk, 1956).

Clearly, initial familiarity with the figures was an aid to learning.

When new concepts can be tied to past experiences, learning is facilitated. A housewife can look in the refrigerator and remember easily eight or ten things she needs from the store—whereas her husband, being un-

familiar with the job of keeping the refrigerator stocked, may have a hard time remembering four or five such items. Skillful teachers try to lessen the unfamiliarity of new concepts by relating them to what the learner already knows.

Meaningfulness. Many studies employing both meaningful and nonsense materials have demonstrated clearly that the rate of verbal learning depends greatly upon the meaningfulness of the material.

In one early study a group of subjects learned in succession 200 nonsense syllables, 200 single digits, 200 words of meaningful prose, and 200 words of meaningful poetry. This procedure provided a comparison of the rates of learning for equal amounts of material with different degrees of meaningfulness. The relative difficulties of the different kinds of material were determined by the average time taken to learn each set, as shown in the following table (Lyon, 1914).

Number of Items	Kind of Material	Minutes Needed to Learn (Average)
200	nonsense syllables	93
200	digits	85
200	meaningful prose	24
200	meaningful poetry	10

It is clear from these figures that the meaningful prose and poetry were learned more readily than the meaningless series of nonsense syllables or the digits. Of course, such findings are merely scientific confirmation of what we might expect on the basis of common experience.

Various theories have been offered to explain the greater ease of learning meaningful material. One holds that meaningful material is initially more familiar to the individual than nonsense material and that hence not all of it must still be learned. To the extent that certain verbal symbols themselves are already familiar to the individual, it is logical to expect that the effects of the individual's prior experience with those concepts will facilitate his learning any material which involves them. In other words, meaningful material receives an advantage from previous experience—which implies that meaning itself is a product of learning.

Familiarity, however, is not the only factor contributing to the meaningfulness of material. Even very familiar words convey little meaning if they are unrelated and have no logical organization. Thus meaningful prose, in which

the words have structured relationships, is easier to learn than a random list of meaningful but unrelated terms; and simple poetry is even easier to learn because it possesses the additional structuring elements of rhyme and rhythm.

Familiarity and organization thus both contribute to the meaningfulness of material, and they work together to determine the ease of verbal learning. Good teachers, trainers, and curriculum planners take great pains to make their subject matter meaningful. They proceed when possible, from the familiar to the new, from the simple to the complex—taking the learner from where he is to where he must go.

EFFICIENT CONDITIONS OF PRACTICE

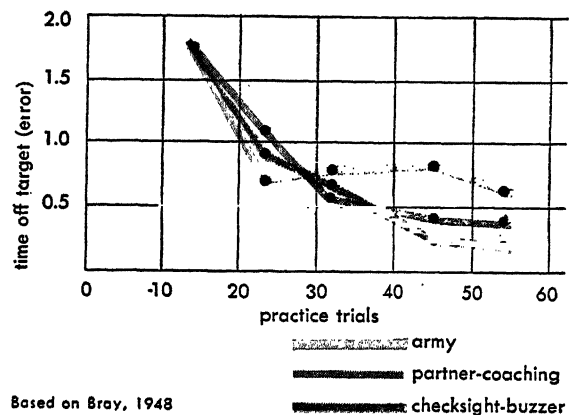
Much careful research over the past fifty years has helped psychologists to define the conditions that are most conducive to efficient learning.

Knowledge of results. Considerable experimental evidence indicates that the person who has knowledge of his progress in learning will demonstrate more rapid learning performance than the subject of comparable ability who is working "in the dark." Knowledge of results may be gained in either one of two ways: (1) the individual may be told of the correctness of each attempt or response as it is made; or (2) the individual may be kept informed of the overall progress of his learning.

An interesting example of a study using the first method is an experiment on training gunners to "track" targets with the 40-mm gun. The task in tracking involves continuous sighting of the gun on a moving object in order to keep it on target. Tracking with the 40-mm gun requires two men, one to follow the horizontal movements of the target and the other to follow the vertical movements. The standard Army method of training in this skill was to give verbal instructions and coaching before, during, and after gunnery practice.

Three experimental conditions were used to test the efficiency of this training method. In Group A the standard Army method was used; in Group B each man coached the other in turn; and in Group C a special telescopic sight mounted on the gun was used to check the accuracy of aim, so that the instructor could sound a buzzer whenever the gun was off target. The men in Group C, who were also told what scores they had made at the end of each course, improved much more rapidly than did those

Improved Performance with Knowledge of Results



in the other groups. The standard Army method proved the least effective of the three (Bray, 1948).

If there is a delay before the subject receives knowledge of the results of his efforts, learning seems to be less efficient.

In a recent experiment subjects had to draw a three-inch line while blindfolded, with information concerning the accuracy of the line being delayed for 0, 10, 20, or 30 seconds. Increasing the length of the delay reduced the rate of learning, but even the thirty-second delay gave better results than were obtained when no knowledge of results was given (Greenspoon and Foreman, 1956).

In recent years psychologists have tended to replace the term "knowledge of results" with the more general expression *psychological feedback* (Brown, 1949). Psychological feedback is the process whereby the organism gains information concerning the correctness of his previous responses in order that he may make adjustments in his behavior to compensate for his errors. This concept will be further discussed in the chapter on communication. It is sufficient to say here that psychological feedback involves a complex interaction between motives, goals, and information regarding progress toward those goals.

Distributed vs. massed practice. Suppose that a person has a month in which to learn some task, such as memorizing the lines of a play or acquiring some simple motor skill, but in that period of time can afford to devote only thirty hours to practice. In such circumstances he could, for example, study six hours a day for five days, or he could work ten hours a day

for three days, or he could work an hour a day for thirty days, two hours a day for fifteen days, or three hours a day for ten days, and so on. All these schedules involve the same amount of total time devoted to learning. The choice, essentially, is between *distributed practice* (short, well-spaced learning periods) and *massed practice* (long, concentrated learning periods). Which one of these procedures will allow the greatest and most permanent improvement?

Unfortunately there is no ready-made answer, for a number of factors are involved in determining what distribution of practice is most efficient in a given case. In many tasks, for example, the individual enters the learning situation "cold" and must have a period of "warming up" before going to work in earnest. Before tackling an assignment the student may have to gather his materials together, sharpen his pencil, adjust the light, find his place in the book, and begin to organize his thinking. All this preparation takes time, but it need not be repeated during a particular study period. Thus under conditions of massed practice the student would lose considerably less time in warming up than he would if he distributed his learning time into a number of short practice sessions.

The most obvious advantage of massed over distributed practice is the fact that forgetting occurs between learning sessions. If the practice sessions are placed too far apart, considerable forgetting may occur between periods. On the other hand, performance which requires effort also produces fatigue. The greater the physical or mental effort involved in a task, the greater is the degree of muscular and nervous fatigue that results from practicing it. In tasks requiring considerable effort, therefore, distributed practice may be superior, for rest pauses overcome the lowered efficiency which accompanies fatigue.

Fatigue may be a powerful factor in any learning that involves the use of heavy muscles, but it affects mental work much less than boredom does. Even the most interesting activity tends to become boring if it is continued too long. Such boredom lowers motivation and reduces attentiveness. Thus another advantage of distributed practice may be that it serves to keep interest fresh and to maintain a satisfactory level of motivation.

Distributing rote learning. Psychological studies have consistently shown that rote, or

verbatim, learning of verbal materials progresses more rapidly when practice is distributed in frequent short periods.

A classical experiment performed several decades ago and verified by other investigators (Henry and Wasson, 1939) compared four different methods of using two hours of time in memorizing a code. One group of subjects practiced for ten minutes twice a day for six days; a second group practiced twenty minutes once a day for six days; a third group practiced forty minutes every other day for six days; and a fourth group practiced two hours at one sitting. The ten-minutes-twice-a-day and the twenty-minutes-once-a-day groups learned most effectively and were about equal in efficiency. The group which practiced two hours at one sitting was least efficient of the four, while the group which practiced forty minutes every other day was intermediate (Starch, 1912).

These results indicate that for simple verbatim learning distributed practice is more efficient than massed practice.

More recent studies have, on the whole, supported this conclusion. For example, in a series of experiments on distribution of practice one investigator found that lists of either nonsense syllables (Underwood, 1953a) or adjectives (Underwood, 1953b) could be learned more rapidly through distributed than through massed practice.

As the complexity of the rote learning task increases, however, distributed practice tends to lose its margin of superiority. In the series of studies just mentioned, distributed practice no longer brought more rapid learning when nonsense syllables had to be learned in *pairs*, although fewer errors occurred in distributed than in massed practice (Underwood, 1953c). In the learning of paired adjectives, items which needed to be reinforced only a few times for learning to take place were better retained if acquired by distributed practice. Items which needed many reinforcements, on the other hand, were better retained following massed practice (Underwood, 1953d). More complex items, which the learner must go over several times, would thus seem to be learned more efficiently in long practice periods.

This relationship between distribution of practice and complexity of the situation is further demonstrated in an experiment in which different groups of subjects learned nonsense material of varying complexity.

The subjects in this study were required to learn to make the correct nonsense syllable responses to meaningless symbols. Three tasks of varying complexity were set up, and each task was assigned to one group learning under massed practice (eight seconds between trials) and to another group learning under distributed practice (two minutes between trials). Thus there were six groups of subjects involved in the experiment.

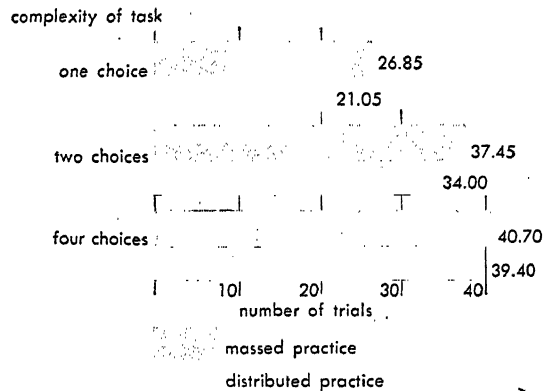
In the simplest situation the stimulus symbol was presented alone for two seconds, after which the stimulus symbol and the correct nonsense syllable response were presented together. Then the next stimulus symbol appeared, followed by its correct response. The task was to learn to make the correct response to each stimulus when it appeared alone. The entire series consisted of eight such stimulus-response pairs. The procedure for the other groups was the same, except that each stimulus was followed at the second level of complexity by two response terms and, at the third level of complexity, by four response terms, only one of which was correct. In other words, at the levels of greater complexity the subjects had to discover the correct response, whereas at the simplest level no element of choice or discovery was necessary.

The results of this study are summarized in the diagram at right. As the diagram indicates, the number of trials required to learn the correct nonsense responses to the stimulus symbols increased under both massed and distributed practice as the task became more complex. In the simplest situation distributed practice was clearly superior, requiring considerably fewer trials. However, as the problem became more complex and depended more heavily upon discovering and learning the correct response from a number of possibilities, the advantage of distributed practice over massing tended to disappear (Riley, 1952).

Other studies involving considerably more complex tasks indicate that massing actually becomes superior over distribution when the task requires a large degree of discovery (Cook, 1934; Ericksen, 1942).

Distributing ideational learning. As we have seen, as subject matter becomes more meaningful, the superiority of distributed practice—demonstrated in rote learning of nonsense material—tends to decline or even to disappear. Whereas nonsense material (or, indeed, verbatim learning of any kind) usually becomes boring quite soon, ideational material is generally much more interesting and will maintain motivation over a considerably longer period

Mean Number of Trials Required to Make One Perfect Recitation



of time. A student might easily concentrate for an hour or two on an interesting assignment, especially if he is trying to grasp general ideas and new relationships. Further learning, on the other hand, may best be achieved through brief review of the material from time to time. For learning ideas and principles, the best procedure seems to be a period of massed learning followed by distributed learning.

In logical reasoning problems, massed practice has been shown to be generally superior.

When college students were given twenty minutes to solve such a problem, those who worked without interruption for the whole time did better than those who worked for a minute at a time, with thirty-second rest periods between each interval (Shaklee and Jones, 1953).

Sometimes, of course, an individual devotes a long, concentrated period of study to some task and at the end of that time still has made little progress in grasping the basic relationships. This is particularly true of some types of problem solving, such as those the student encounters in mathematics or physics. In such a case, failure to show progress may be due to an incorrect mental set which is interfering with perception of new relationships in the situation. Investigation has shown that this type of persisting mental set is more likely to develop under massing than under distributed practice.

In one study two groups of subjects were given a series of simple arithmetic problems which involved manipulating the contents of different-sized containers in order to obtain a specified amount of

something. For example, they had to figure out how to get 40 cubic inches of beans from a bin by using three containers that would hold 29, 59, and 5 cubic inches respectively. One solution in this case is to fill the largest container; empty 29 cubic inches from it into the 29-cubic-inch container; and then add 10 more cubic inches by filling the smallest container twice. This leaves the specified amount of beans in the large container.

A series of such problems, all of which could be solved by this same formula, were given to both groups of subjects. Group I was given the problems one right after another, whereas Group II had a three-minute interval between each problem. Then both groups were given a test problem which could be solved either by the same formula or more directly by simply subtracting the contents of one container from another. The results showed that only 26 per cent of Group I (massed practice) solved the test problem by the direct method, whereas 48 per cent of Group II (distributed practice) did so. Evidently the mental set leading to an indirect solution was greater for the group which had massed practice in using the indirect method (Kendler, Greenberg, and Richman, 1952).

These results suggest that when little progress is being made in solving some problem, the most efficient procedure may be to drop the activity temporarily and return to the problem after an interval of rest. This agrees with the age-old advice to "sleep on it" before acting on a solution to an important and perplexing problem. Sometimes things look quite different when they are reexamined after a period of not thinking about them.

Distributing motor learning. Because muscular fatigue often occurs rapidly in the performance of motor skills, distribution of practice is especially important in motor learning.

In one typical experiment two groups of twenty-five subjects tried to keep a stylus in contact with a moving brass target which rotated in a heart-shaped pattern. Both groups received thirty fifteen-second trials a day for two days. The distributed-practice group received a forty-five-second rest period between trials, with a five-minute rest period at the end of each block of six trials. The massed practice group had no interval between trials except for the five-minute rest period at the end of each six trials. Performance was measured in terms of the number of seconds per trial that the subject made contact with the moving target. Although both groups were equivalent in performance at the out-

set, the distributed-practice group showed consistently superior performance thereafter. In fact, their performance became clearly superior after only ninety seconds of practice (Barch, 1952).

In another study subjects learned to print the letters of the alphabet in inverted form more rapidly under distributed practice than under massed practice. However, after all subjects were given a five-minute rest period, those who had learned by massed practice gave a better performance on four additional trials than did those who had learned by distributed practice (Archer, 1954).

It may be, as the investigator suggests, that with massed practice the individual finds each response more effortful but learns more per response.

Considerable attention has been given to the problem of how long rest periods should be to obtain optimal results from practice.

In one study the influence of rest periods of different lengths was determined for a task involving pursuit of a target which changed in speed as well as course. With a constant practice period of five minutes, a twenty-minute rest period was found to be more effective than rest periods of five minutes, forty-eight hours, seventy-two hours, or one hundred twenty hours (Travis, 1937).

With longer practice periods, longer periods between practice are required for highest efficiency in learning; with shorter practice periods, the interpractice interval can be shorter, and the maximum learning rate still be maintained. The optimal length of rest periods for learning different skills is, of course, largely dependent on the nature of the particular task. Various investigators have shown that the introduction of brief rest periods is especially valuable during the early trials in motor learning (Snoddy, 1935; Bell, 1942).

Thus motor learning and ideational learning are quite different with regard to the distribution of practice. In the former, distributed practice followed by massed practice gives the best results; in the latter, the formula is reversed.

Reading vs. reciting. In reading, we are, essentially, on the receiving end—taking in someone else's ideas. Our understanding and memory of these ideas may be accurate or inaccurate, clear or hazy. The only way we can be sure is to close the book from time to time and see if we can reproduce what we have read. As might be expected, studies have shown

that time spent in active recitation such as this leads to more effective learning. In one experiment it was found that when four fifths of the study time was spent in an active attempt to recall, twice as many items were learned (Gates, 1917).

Whole vs. part learning. A learner faced with the task of mastering a large and complex task can go through the whole task from beginning to end and then repeat the cycle, or he can break the whole task into parts and learn each one separately. An enormous amount of research on the problem of which procedure is better has produced no simple answer. Each way of scheduling has its advantages and its disadvantages.

Factors of advantage in part learning. In rote learning, as we have seen, short tasks are proportionately easier to learn than long tasks. Therefore, a series of parts should be easier to learn than the whole made up of those parts. This is particularly true in the case of nonsense material.

In the part method the subject gets knowledge of progress sooner and is thus encouraged to try hard. Another advantage is that each part is learned to mastery and then dropped for the moment. This eliminates spending more time than is needed in going over easy parts.

Factors of advantage in the whole method. Since meaningful material is easier to learn than nonmeaningful material, the whole method has at least one major advantage over the part method. When the whole task is broken up into parts, the parts frequently become less meaningful because continuity and relationships are lost.

When material is learned by the part method, the parts must eventually be put together. This makes necessary the additional task of learning the transition between parts. The lack of need for this step in the whole method gives it another advantage.

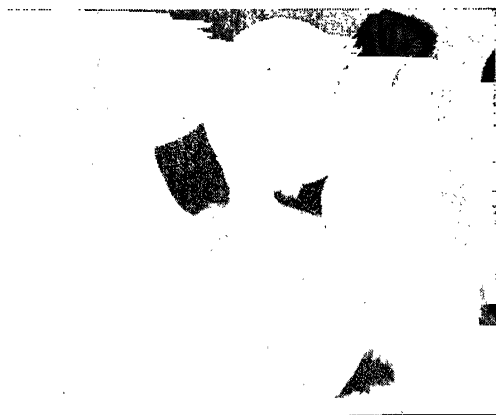
Flexibility of method. Probably the best results in practical learning situations will be obtained when the part and whole methods are combined. Go over the whole task a few times to get the advantage of meaning and continuity and to detect the difficult parts. Give the difficult parts extra effort, and then practice the whole task again.

The influence of prior activity. The efficiency of practice is influenced by what we have already learned or have been learning just before. The experimental design used to study this effect is quite simple:

Experimental Group	Control Group
Learn task A	Do not learn task A
Learn task B	Learn task B

If the experimental group learns task B better than the control group does, the effect is called *proactive* (forward-acting) *facilitation*, or *positive transfer*. If the experimental group does not learn task B as well as the control group does, the effect is called *proactive inhibition*, or *negative transfer*. It has been suggested that the phenomenon of proactive inhibition may explain the fact that amounts of material beyond the memory span become increasingly difficult to learn.

Results from various studies indicate that positive transfer will result when the prior



Vicki, a chimpanzee raised by Dr. and Mrs. Keith Hayes, discovered that she could hear the ticking of a watch by holding it up to her ear. Later she saw a picture of a watch in a magazine advertisement and tried to listen to it. This is a simple example of positive transfer.

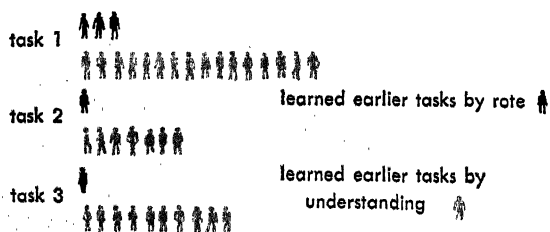
task and the present task have many *common* stimulus-response combinations. When the stimuli of the prior activity are to be related to *different* responses in the present activity, negative transfer is likely to take place during the first few trials on the new task. When the two learning situations have nothing in common, there will be no transfer of either kind. These relationships were demonstrated experimentally in a recent study of transfer between two motor-learning tasks in which subjects had to manipulate levers in response to colored lights. The amount of transfer increased as the similarity between the two tasks increased (Duncan, 1953).

Specific transfer effects are generally too small to justify a student's learning a useless subject in the hope that it will help him in some other area. On the other hand, it has been found that methods and techniques of work, ideals and attitudes, as well as knowledge of general principles and relationships, may readily be transferred from one school subject to another (Commins and Fagin, 1954).

The importance of understanding general principles rather than merely learning by rote has been shown in a recent series of studies in which high school students learned a number of card tricks.

One group of subjects simply learned the order of the cards by rote memory; the other was taught the principles of the tricks. It was found that the understanding group required more time to learn the tricks than did the memorization group. Overnight retention was equal for the two groups. But when new problem-solving tasks involving some of the principles formerly used were presented, the understanding group showed greater transfer by being much more successful at the new tasks than the memorization group (Hilgard, Irvine, and Whipple, 1953).

Number of Subjects Making Perfect Scores on Three Problem-Solving Tasks



Based on: Hilgard, Irvine, and Whipple, 1953

Verbalization in motor learning. Studies of human learning have demonstrated that verbalization plays an important role in acquiring skills which outwardly appear to be almost entirely motor habits. Individuals who employ verbal formulas in learning motor skills tend to display superior performance over subjects who do not verbalize their task.

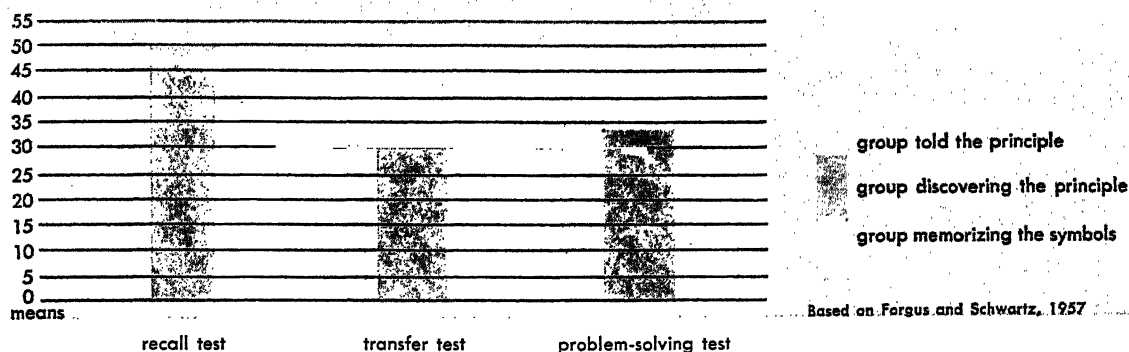
This was demonstrated in an experiment in which six groups of children learned to assemble a mechanical puzzle. In each group the experimenter demonstrated the assembly procedure to the subjects but with different amounts of verbal explanation. As the table below indicates, the greater the amount of verbalization, the more rapidly the children learned the task (Thompson, 1944).

Group	Procedure	Average No. of Trials Required
1	silent demonstration given, with child required to count in order to prevent verbalization of the task	25
2	silent demonstration, but child describes the procedure orally	22
3	demonstrator gives partial description of the task, and child watches silently	16.2
4	demonstrator describes the procedure fully, and child watches silently	14.1
5	child describes the procedure; teacher makes corrections when the child's description is in error	12.4
6	same procedure as Group 5, except that the pieces are numbered in the order in which they are to be assembled	9.5

Verbalization has also been shown to be a valuable aid in human maze learning, a popular laboratory technique for studying the acquisition of motor skills (Warden, 1924; Husband, 1928).

Guidance as an aid to learning. One practical problem faced by the teacher is just how much guidance to give the student. In general it has been found that, when given early, guidance helps establish the correct habits right from the start. Such guidance may include stating necessary general principles and pointing out errors. In the learning of motor skills specific guidance is especially impor-

Effects of Learning Method on Recall, Transfer, and Problem Solving



tant. It must not be continued too long, however, for the learner must eventually perform the task by himself and should not become overdependent upon specific guidance (Hovland, 1951).

The importance of making sure that the learner understands general principles was brought out in a recent study in which college girls were asked to learn a new alphabet of triangles and other abstract symbols.

Each student received a piece of paper with the symbols printed under the corresponding letters of the ordinary alphabet. One group also received a written account of the principle by which the symbols had been arranged in their particular order. A second group was told that there was a principle, but the members were asked to discover it for themselves. The third group simply memorized the symbols. In recalling the code alphabet itself, translating paragraphs written in it, and learning new code alphabets based on similar principles, the first two groups were far ahead of the memorization group in performance. The group which had been told what the principle was, was slightly superior to the one which had to discover the principle, but not significantly so (Fergus and Schwartz, 1957).

In addition to making certain that students understand underlying principles, the teacher must constantly relate new knowledge to what is already known. He must understand the maturation process so that he can be certain that his pupils are ready for new learning experiences and avoid forcing them into activities for which they are unprepared. He must create a classroom atmosphere in which each student feels free to express himself. Although the teacher initiates new experiences, he can make certain that these will be meaningful to the students by allowing them

to take part in group planning. Furthermore, by formulating questions for discussion, clarifying students' ideas, and providing constant encouragement, the teacher can do much to make learning more rapid and more lasting. Thus, in a number of ways, the teacher's guidance can make efficient learning possible without preventing the student from relying ultimately on himself.

Special aids to learning. Today the simple blackboard is only one of a vast assortment of materials used in teaching. Considerable research has centered around the use of such audio-visual aids as slides, films, charts, models, actual specimens, and television. Films and television seem especially promising as aids to learning and will probably be used increasingly in this period of bulging school enrollments and teacher shortages.

In the use of all such materials as these, it is particularly important for the teacher to guide the students' perceptions. As we have seen in Chapter 10, many factors influence what is perceived by different persons in a given situation. Thus it is essential for the teacher to make certain that important ideas stand out clearly against the background of less important details. Often the pattern needs to be pointed out explicitly or the various elements need to be specifically organized into a meaningful whole. Creating a favorable set or predisposition before using visual aids and providing specific training in observation will also aid learning. It is particularly important for the teacher to relate audio-visual aids to the students' present interests and past experiences.

Films. Many studies have shown that the use of films hastens learning, but not all films are equally effective. Those which provide "audience participation"—such as having the

viewers actively practice materials covered by the film at intervals while it is being shown—are superior to those which provide only passive review (May *et al.*, 1947). The key factor here is probably the increased opportunity for student practice rather than an increased motivation to learn (Michael and Maccoby, 1953).

The nature of the commentary is also very important in determining the effectiveness of a film.

One recent study, in which different commentaries were given with the same film on meteorology, revealed that technical and numerical data are learned best when presented in both pictures and sound and that the use of vivid words, repetition, and specific directing of attention to important aspects of the picture are aids in learning. In this study students who merely heard the best commentary learned 80 per cent of the facts learned by those who both saw and heard the film (Nelson and Vandermeer, 1953).

Another study of films which showed the tying of common knots revealed that commentary addressed directly to the listener—that is, in second person (you) and imperative mood—was more effective than first or third-person commentary (Zuckerman, 1952). Commentary preceding the picture was superior to commentary following it. These same principles apply also to teachers' presentation of new arithmetic or other processes in the classroom. Students are helped by being given an overview so that they know what to look for.

Television. An even newer technique, television, combines the advantages of motion pictures with a quality of on-the-spot freshness. This great mass medium of communication has been tried in a number of city school systems, and its overall effectiveness as a teaching aid is still being evaluated. At the college level, Iowa State College was a pioneer in television instruction, with general psychology the first college credit course presented over its station. Although education was the primary purpose of the course, the set-up was planned so that research on the value of TV instruction was a by-product.

Five groups of students were included in the study. One group watched the program at home but came to the campus to take the regular examinations; a studio class viewed the program at the studio as it

was being presented; a kinescope class watched films of the TV talks, with twenty minutes of informal discussion afterwards; and two campus classes covered the same materials in the usual classroom manner. Grade-point averages showed that the TV-at-home group did better than any of the others except the kinescope group, which viewed the same programs but had the advantage of discussion afterward. The kinescope group felt, however, that the film presentations were less personal and interesting than the instructor's "live" presentation (Husband, 1954).

A more comprehensive study of closed-circuit television for college teaching was designed to investigate the effectiveness of television (1) in providing instruction for larger numbers of students at lower cost and (2) in improving the quality of instruction by introducing greater realism and placing less emphasis upon lectures and textbooks. Psychology and the lecture-demonstration part of chemistry were the courses used.

In general this study revealed no significant differences in informational learning by students taught by TV and by ordinary methods. Students found instructional television acceptable, but their attitudes toward it, as compared with direct instruction, were neutral or slightly negative. Faculty members, although willing to accept closed-circuit television on an experimental basis, did not prefer it to their usual teaching procedures. Administrators accepted it as one means of solving problems related to increased enrollment and shortages of instructors and space (Carpenter and Greenhill, 1955).

Although the equipment used in this particular experiment worked out well, there are still many problems which need to be solved before the technique can be adopted on a wide scale. Although the whole question of television as an instructional medium needs further research, it appears to have excellent possibilities.

LEARNING

UNDER SPECIAL CONDITIONS

An interesting group of recent experiments has investigated the possibility of learning during sleep or under hypnosis.

Learning during sleep. For a time there seemed to be some hope of utilizing sleeping time for furthering one's education, since cer-

tain studies had suggested that learning might occur during sleep (Fox and Robbin, 1952; Leuba and Bateman, 1952).

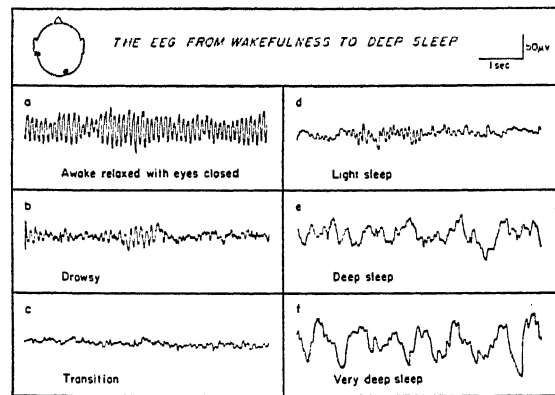
More recent studies of learning during sleep, however, have shown less favorable results. In two studies in which the subjects were actually watched during the experiment and the material was presented only while they were clearly sound asleep, there was no effect later on learning while awake (Hoyt, 1953; Stampfl, 1953). One pair of investigators felt that the conflicting results of sleep-learning experiments could be explained by the fact that one or more variables were inadequately controlled in the studies showing favorable results. They suggested that if learning *did* occur during the night, it probably took place in a special kind of waking state which the subjects did not recognize or recall (Simon and Emmons, 1955). To test this hypothesis they decided to make absolutely certain just how fast asleep their subjects were by using the electroencephalogram (EEG) on them continuously while they slept. As you can readily see from the illustration at right above, the EEG pattern is very different at different levels of sleep. The waking pattern is characterized by the "alpha rhythm," which disappears as the subject goes to sleep.

The experimenters attached the EEG electrodes to the subjects in such a way as to cause them no discomfort. The learning material—ten one-syllable nouns—was recorded on magnetic tape and played through loud-speakers in the booths where the subjects slept. Each EEG was continuously monitored, and the training material was played only when alpha frequencies had been absent for thirty seconds. The recorder was turned off if the alpha frequencies reappeared or if muscle movement was observed.

In the morning the subjects were asked to select the ten nouns in the learning material from a list of fifty. The same list had been given to a control group who were told that they were participating in an experiment on extrasensory perception and were asked to choose the ten words the experimenter had formerly chosen. The subjects who had heard the words while asleep did not choose a significantly greater number of correct words than did the controls (Emmons and Simon, 1956).

Thus learning did not occur when the factor of depth of sleep was adequately controlled.

Learning under hypnosis. Another interest-



ing but inadequately explored topic is the influence of hypnosis on learning and retention. Most of the investigation in this area has been with conditioning under hypnosis (Leuba, 1940; Naruse and Obonai, 1953, 1955). During hypnosis a stimulus and a response are paired a few times. For example, the hypnotist may touch the subject's arm while he is coughing or may snap a cricket while he is smelling camphor. After the subject is awakened, amnesic for the conditioning process, he will cough or show a tendency to do so if his arm is touched. Or, if the experimenter snaps a cricket, the subject will wonder why he suddenly smells camphor in the room.

Studies of more complex learning processes during hypnosis are rare. One early experimenter, however, had subjects learn nonsense material and compared the rate of learning under hypnosis with the rate of learning when not hypnotized (Strickler, 1929). He found that during the first few trials, the rate of learning was faster in the hypnotized state but that in the later trials the rate was almost identical. There was no significant difference in total performance.

A much more recent experiment investigated the effect of hypnosis on the learning of the Morse code.

Subjects who learned the code while under hypnosis made fewer errors in subsequent tests (all conducted in a waking state) than did subjects who learned the code without being hypnotized. The difference between the two groups was significant on the test given thirty hours after learning (Sears, 1955).

Another recent experiment had to do with altering the subject's sense of time under hypnosis and then testing his learning perform-

ance. As we saw on page 290, an individual's inner sense of time can be so distorted by suggestion under hypnosis that a period of seconds will seem to him to be many minutes.

A standard learning experiment with letter groups was arranged, using pairs of three-letter groups printed on cards. In the first part of the experiment, 150 pairs (five pairs at a session) were shown to the subject and read to him slowly. Then he was allowed to print the letters five times and study them. This took about 26.5 seconds per pair. After a set of five cards was learned in this way, the whole set was run through to test the learning. After shuffling the cards the experimenter would read the first item of each pair, and the subject would give the second if he could. Then the card was displayed, and the subject was allowed to study it for five seconds. This running through the cards was repeated until he could give the second group of each pair perfectly.

Next the subject was hypnotized, his sense of time was altered, and the experiment was repeated with a new series of cards. In this case the subject kept his eyes closed and printed the letters only in his imagination. He was allowed only five seconds per pair instead of the twenty-six used while he was awake. Under hypnosis he was able to master equivalent material in less than one fourth the time it had taken him when awake. And the learning seemed easier and more leisurely. Tested after twenty-four hours, the subject had retained a greater proportion of the materials learned under hypnosis and could relearn the forgotten material in less time (Cooper and Rodgin, 1952).

Although these experiments suggest that learning under hypnosis may be quicker and longer lasting than learning under ordinary conditions, several unexplored factors are involved, more experimentation is needed.

FACTORS

IN FORGETTING

Research has revealed a number of factors which seem to influence how well we remember what we learn—and for how long. Our learning performance immediately after practice tells only part of the story. The things that interest us most are how well our learning will stick and how accessible it will be for actual use later on.

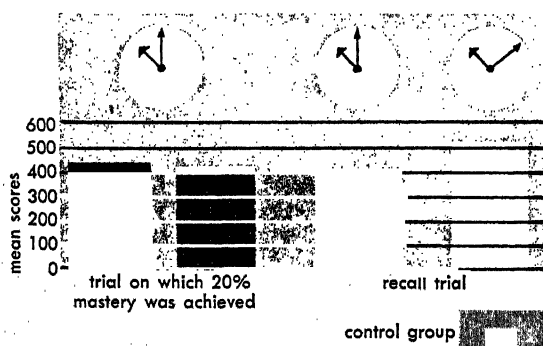
THE COURSE OF FORGETTING

Some of the earliest research in psychology was devoted to plotting the “normal” curve of forgetting. As we might expect, the findings in most cases indicated that forgetting does not proceed at a steady rate.

Curves of forgetting. Forgetting usually seems to be most rapid immediately after the end of the learning period. As time goes on, the remaining knowledge becomes more and more stable. This fundamental fact—that most of what we forget is forgotten soon after it has been learned—was first discovered by the German psychologist Ebbinghaus and has been verified repeatedly (Ebbinghaus, 1885; Cain and Willey, 1939). The graph on page 342 shows a typical curve of forgetting. Notice the sudden initial drop, after which the curve tends to level off.

Improvement after practice ceases. Although in most cases forgetting begins immediately, it sometimes happens, when the original learning has not been carried to complete mastery, that the learner is able to remember or recall a *larger* amount of material later on than he can immediately after

Reminiscence after Learning a Motor Skill to 20 Per Cent Mastery



For the trial on which both groups met the criterion of 20 per cent mastery in learning a motor skill, the mean score for the control group was 446.2 and for the experimental group, 438.8. The control group took the recall trial immediately afterward and scored 417.8, showing a slight loss. But the experimental group, which took the recall trial after a delay of ten and a half minutes, had a score of 523.4—the gain representing the effect of reminiscence.

Based on Buxton, 1943

practice ceases. This can happen even when he has not practiced in the meanwhile, either by actually going over the materials or by reviewing them mentally.

Psychologists call this phenomenon *reminiscence*. The degree of reminiscence evidently depends on many factors, including the following:

1. *Meaningfulness of the material*. Research has shown that there is a greater degree of reminiscence with meaningful material than with nonsense material (Martin, 1940).
2. *Determination to recall*. Individuals who try hard to recall show a greater degree of reminiscence than those who give up more easily (Martin, 1940).
3. *Degree of mastery of the task*. In motor learning, at least, the degree of reminiscence increases up to a certain point as degree of mastery of the task increases. Beyond that point further mastery of the task reduces the degree of reminiscence (Buxton, 1943). Perhaps this is because less improvement is possible.
4. *Length of time involved*. Fast learners show more reminiscence than slow learners do over short periods of time (a few days to a few weeks). But slow learners show more reminiscence than fast learners over periods of a few months. This is true both for nonsense syllables and for motor learning (Leavitt, 1945).

Reminiscence is explained partially perhaps by the fact that fatigue and temporary satiation with a task—both of which may reduce the level of performance immediately after learning—are removed after a period of rest. Another factor may be that additional experience in situations similar to the learning situation enable the individual to organize his learning better and to use it more effectively.

In any case, the phenomenon of reminiscence indicates that performance immediately after practice has been completed does not necessarily reveal all that has been learned. It also suggests that the forgetting process is not one of passive decay but rather involves dynamic forces which continue to interact with each other and with newly introduced forces long after the original learning has taken place.

Do we ever forget completely? Since curves of retention indicate that very little forgetting occurs following the first large loss, psychologists have been led to speculate whether a habit is ever forgotten completely.

In one of his later experiments Ebbinghaus relearned stanzas of Byron's poem *Don Juan* after a lapse of twenty-two years. At the time the relearning was started, no evidence of memory was apparent upon introspection, and there was no objective recall of the lines of the poem. The time required to relearn these stanzas was less, however, than that required to learn stanzas which had never been studied previously (Ebbinghaus, 1905).

During old age, long "forgotten" youthful memories tend to recur. The writer once observed a typical case of a German-born person who had come to the United States as a young man and had not used his original language for nearly sixty years. He began to complain that he found himself forgetting English words for familiar objects and that the German words kept introducing themselves in their place. Many such cases have been reported of the spontaneous recurrence of memories of which the subjects had been completely unconscious for long intervals of time. One psychologist cites the case of his father who, at the age of ninety years, suddenly recalled a poem he had learned seventy-five years before and apparently had not rehearsed since (Warren, 1918).

In another case a woman of sixty repeated the answers to the 107 questions of the Westminster Shorter Catechism. She repeated 54 answers perfectly and 44 more with very little prompting. She had not had even incidental practice for forty years except for a test she was given at the age of forty-four. At that time she gave 53 answers perfectly and 39 more with only a word or two of prompting (Smith, 1951).

The above examples indicate that early memories are often long-lasting if not permanent. The detailed recall of apparently forgotten events which takes place under hypnosis also points to the possibility that complete forgetting seldom if ever occurs. However, the question of whether or not we ever forget completely has not yet been answered satisfactorily. It is complicated by the emotional factors which affect memory. These factors will be discussed in a later section of this chapter.

WHAT MAKES US FORGET?

As we have seen, there is evidence that forgetting is not merely passive decay which

occurs over a period of time when a habit is not practiced or used. Indeed, studies indicate that forgetting is not inevitable, even during a period of disuse, and that when it occurs it is a function of several dynamic factors. Many of these can be controlled directly or indirectly by learner and teacher.

Influence of intervening activity. We have seen that prior activity can either inhibit or facilitate new learning. In much the same way, the activity that *follows* learning can either hinder or help remembering. We refer to this as *retroactive inhibition* or *retroactive facilitation*, depending upon whether the influence is unfavorable or favorable. The amount of forgetting which occurs in a given period is strongly affected by the nature of the activity which intervenes between learning and recall.

Effects of sleeping or waking. A given length of time spent in the ordinary activities of the waking day usually brings more forgetting than the same length of time spent in sleep (Jenkins and Dallenbach, 1924), as can be seen in the chart below (Van Ormer, 1932). This suggests that forgetting is brought about more by the destructive effect of other activity than it is by the mere passage of time.

Effects of new learning. As might be expected, different kinds of waking activity have different effects on the retention of material just learned.

In one experiment all the subjects began by memorizing a list of adjectives. Then, after a ten-minute interval, all were tested for retention of this list, both by the method of recall and by the method of relearning (page 314). Thus two scores were secured for each subject: first, a score in terms of per cent recalled; second, a score in terms of readings necessary for relearning.

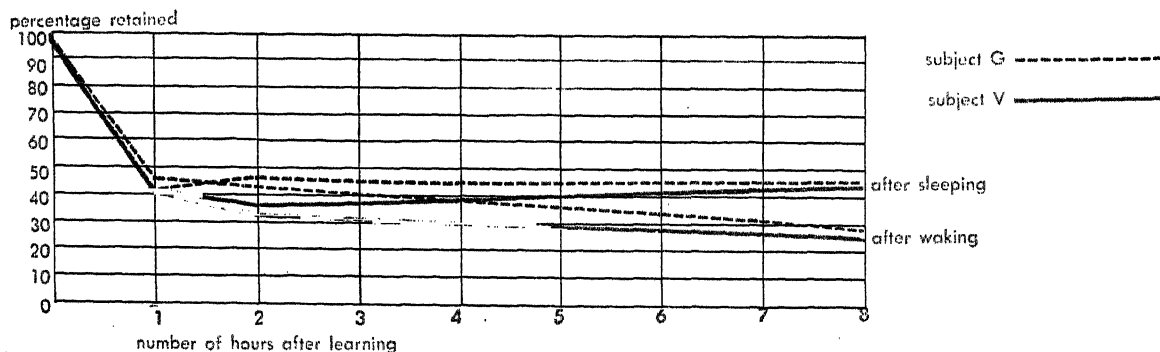
With different groups of subjects, the ten-minute interval was occupied differently. One group of subjects learned a second list of adjectives composed of synonyms of those in the first list, another learned a list of adjectives that were antonyms of the original words, and another learned a list of adjectives unrelated to the original list. Another group of subjects worked with nonsense syllables, while still another used the ten-minute interval to memorize a list of three-digit numbers. The last group rested. When these various groups were then tested for their retention of the original list of adjectives, the results were as shown in the table below (McGeoch and McDonald, 1931).

Group	Per Cent of the Original List Recalled	Readings Required for Relearning
group learning synonyms	12	9.1
group learning antonyms	18	7.0
group learning unrelated adjectives	22	6.7
group learning nonsense syllables	26	7.2
group learning numbers	37	5.1
group with interval of rest	45	5.2

These results show, in general, that retroactive inhibition becomes greater as the similarity between the original learning and the interpolated activity increases.

The thoroughness with which the interpolated material is learned also affects retroactive inhibition. The more thoroughly the new material is learned, the more it interferes

Retention of Material—After Sleeping and After Waking



with the material previously learned. This was shown in a recent study of the learning of paired lists of adjectives (Archer and Underwood, 1951).

Experiments have shown repeatedly that the important factor in interference is the *similarity* between the original learning and the interpolated activity—irrespective of the nature of the material used. Original learning may be of words, numbers, nonsense syllables, geometric designs, or what have you. If what follows is very similar, the interference will be very great; if learning of a different type of material follows, interference will be less. If nonlearning activity follows, the interference will be still less; if sleep follows the original learning, forgetting will be comparatively slight.

Meaningfulness and forgetting. Experiments have shown that meaningful organization of the original material will lessen the amount of forgetting, irrespective of the type of activity that follows.

In a study of the forgetting of meaningful material, subjects read short stories which had been constructed to contain twelve items *not* essential to the plot and twelve items that were essential. The subjects read each story at a different time of day and were asked to recall it approximately eight hours later; the intervening period between reading and recall was sometimes spent in sleeping and sometimes in waking. The material recalled by each subject was scored independently by three different judges with the following results:

Material	Percentage Recalled After Waking	Percentage Recalled After Sleeping
essential	86	87
nonessential	23	47

Under both conditions a much greater percentage of the essential material, as compared to nonessential, was retained. The degree to which essential material was forgotten did not seem to be influenced significantly by the conditions of sleeping or waking, whereas the recall of nonessential material was better after sleeping (Newman, 1939).

Apparently nonessential learning, like the learning of nonsense materials, is more seriously affected by intervening activities than is more meaningful material.

All these findings have definite practical applications, particularly for students. In scheduling your learning periods remember that much forgetting seems to result from the interference effect of ensuing activity—especially of similar activity. If possible, therefore, avoid studying two similar subjects, like Latin and French, one right after the other. In learning important material follow your study period with rest or with an entirely different activity. In other words, schedule your learning periods to avoid as much interference as possible. And because meaningful, organized material tends to resist retroactive inhibition, try to make material as meaningful as possible—especially when you are learning lists, series of facts, or verbatim material of any kind. Whenever possible, try to get an overall picture of the material to be learned and relate it to things you already know.

The importance of review. In order to maintain a high level of mastery after learning, it is important to review as soon as possible after learning and then to review again from time to time. Review should be selective, emphasizing those parts of the material which are most important or most difficult.

If you have achieved an equal degree of mastery over two sets of material, the one you learned earlier will be remembered better over a period of time and can be maintained at the same level of mastery with less review (Woodworth and Schlosberg, 1954; Youtz, 1941). From a practical standpoint, this means that mastery of subject matter becomes more stable the longer it is maintained, requiring less and less review.

The Zeigarnik effect. Experiments show that tasks which are interrupted before completion are more likely to be recalled than tasks which have been completed. This phenomenon is called the *Zeigarnik effect*, after the Russian psychologist Zeigarnik who first demonstrated it experimentally.

In this classical experiment the subjects performed simple tasks which they would be able to accomplish if given enough time, such as writing down a favorite quotation from memory, solving a riddle, or doing mental arithmetic problems. In some of the tasks subjects were interrupted before they had a chance to carry out the instructions in full. In other tasks they were permitted to finish.

Despite the fact that subjects spent more time on the completed tasks than on the interrupted ones,

they tended to recall the unfinished tasks better than the finished ones when they were questioned a few hours after the testing. This superiority of recall for the uncompleted tasks disappeared, however, within twenty-four hours. Apparently it was attributable to short-term motivational factors rather than to a difference in the actual learning of the two sets of tasks (Zeigarnik, 1927).

A familiar example of the effect of non-completion upon memory is provided by the student who studies a difficult mathematics problem just before going to bed. He cannot solve it and so decides to try in the morning after a good night's sleep. However, the problem keeps coming into consciousness, sometimes making sleep impossible. Because it still awaits completion, it remains active in his mind. Even more persistent in refusing to be put aside are the more complex problems of personal life.

Recent evidence indicates that the Zeigarnik effect applies only to memory for tasks performed under nonstressful conditions (Alper, 1952). When the individual performs a series of tasks under stressful conditions where noncompletion threatens his self-esteem, there is a tendency for the Zeigarnik effect to be reversed—that is, for completed tasks to be remembered better than noncompleted ones.

In one experiment a "threatened" group of subjects and a "nonthreatened" group were given a series of puzzle-solving tasks. In each group the subjects were tested individually and were allowed to complete some of the tasks but not others. Instructions given the nonthreatened subjects were designed to prevent the arousal of stress; these subjects were told that the puzzles were for use in a future experiment and that the experimenter only wanted to find out how they would work. The threatened group, on the other hand, was told that the tasks constituted an intelligence test and that if a particular puzzle were not completed within the allotted time it would be scored as a failure. Thus stress was induced by a threat to the individual's self-esteem.

After the subjects had attempted the series of puzzles, completing some and being interrupted before completing others, they were tested for their memory of all the tasks on which they had worked. The nonstress group exhibited the typical Zeigarnik effect, recalling more uncompleted than completed tasks; but the group that had worked under stress showed the opposite results, recalling more completed than uncompleted tasks (Rosenzweig, 1943).

Emotional factors in forgetting. Clinical evidence indicates that painful experiences are more difficult to recall than pleasant ones. People *do* remember, of course, many unpleasant experiences. But when a particular memory threatens the individual's self-esteem, its recall will probably meet unconscious resistance. The following case affords a clear-cut example of this process, a form of repression (page 177).

Two girls about twelve years old had been placed by their parents in a house of prostitution under circumstances that were almost unbelievably degrading. When this situation became known and the girls were encouraged by the authorities to tell their story, they gave highly detailed information which was quite adequate to incriminate their parents and the other people responsible. But when the girls were questioned again several months later, they omitted many of the factual details—even those concerning some of the more drastic parts of their experience. When their earlier testimony was summarized for them, they denied with apparent sincerity that such things had ever happened and said indignantly that the stories must have been made up to discredit them (Erickson, 1938).

In a case like this, where the original experiences had been so vivid and so emotionally significant, we would expect retention of the facts to be easy. But, as we have seen in Chapter 7, repression often acts as a self-protective device, tending to make the person "forget" such painful experiences. As we have also seen, however, repressed material usually stays active at an unconscious level and may produce emotional conflicts.

What happens with the little experiences of daily life which are only *slightly* unpleasant? Is there any tendency for them to be forgotten more quickly than pleasant experiences? Although the evidence is conflicting, it seems to indicate that pleasant memories in general do show a stronger tendency to persist than unpleasant ones (Gilbert, 1938).

With socially controversial material the degree of retention is related to the individual's personal attitudes toward the subject. People tend to learn something faster and remember it better when it is in agreement rather than disagreement with their own attitudes (Levine and Murphy, 1943).

The influence of emotionally toned attitudes on retention is revealed by the following study.

A 350-word passage dealing with the advisability of admitting women students to a male university and containing a number of pro-male, pro-female, anti-male, and anti-female statements was read by both male and female college students. After one reading of the passage the subjects were required to reproduce the material in writing at ten-minute intervals during the following hour. The results showed significant sex differences for recall of partisan items in the passage. Male subjects retained more pro-male, pro-female, and anti-female items than did the female subjects; women subjects retained more anti-male items (see chart on page 346). Although their recall scores were somewhat higher for pro-female items than anti-female items, women were superior to men only in the retention of anti-male material (Alper and Korchin, 1952).

In general these results confirm the principle that people tend to remember best that which is favorable to their attitudes. However, the fact that the women displayed better memory for anti-male items than for pro-female items requires further explanation. The general tone of the passage was derogatory to female students, and the authors of the study suggest that the women's emphasis on anti-male items tended to transform a generally anti-female passage into one which was more evenly weighted in terms of anti-male and anti-female connotations. There is also the possibility that the greater recall of anti-male items by the women could function as a symbolic outlet for aggression. And since members of both sexes retained less of the material which was derogatory to their own sex, there is evidence that repression may have functioned as one of several factors inhibiting recall of unacceptable ideas. The results of this study indicate that the selective recall of emotionally packed material is determined by a complex of dynamic factors operating within the individual.

Dynamic factors in the social environment are also important in memory.

In a recent study of the effects of group atmosphere on recall, subjects were divided into forty groups of four persons each. A story was read to each group; immediately afterward the members were asked to write it down as they remembered it, without talking to any other member of the group. Then each group of four was asked to select a leader and to work together to recall the story. Finally, each member was asked for his individual recollection a second time.

Some of the groups were told that the experiment dealt with cooperative effort and were urged to cooperate with each other as much as possible. The remainder were told that a record would be kept of each individual's contributions to the group effort in order to find out which person had the best memory. This was intended to foster a competitive spirit in these particular groups. Half of the groups were instructed to operate in a democratic manner and to make all decisions as a group, with the leader acting only as a coordinator. The other half were told to regard their leader as "the boss," with authoritarian powers to decide what should be included in the group recall.

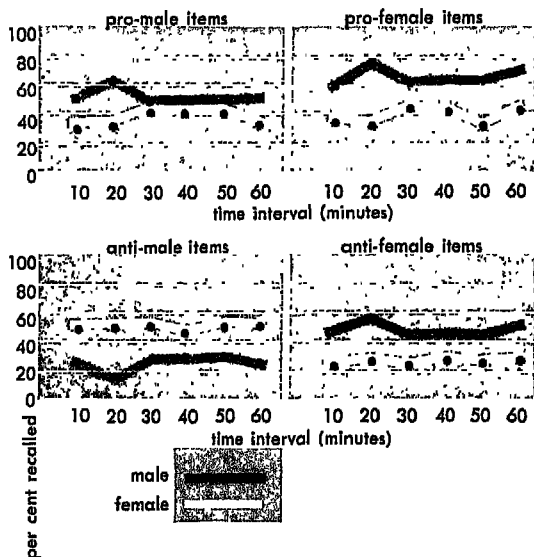
Group recall was superior to individual recall in all cases; but individual recall following the group discussion was superior to individual recall immediately after the reading. The difference in accuracy between group recall and the initial individual recall was greater in the cooperative groups than in the competitive ones. This may have been due either to the cooperative atmosphere itself or to the fact that there was more participation in the cooperative groups (as was indicated by questionnaires which the participants later filled out). No significant differences were found between the democratic and authoritarian groups. When the ten groups showing the greatest degree of improvement between initial and final recall were compared to the ten groups showing least improvement, it was found that the superior groups were those who had been most cohesive in their operations (Yuker, 1955).

Effects of special conditions. Several studies have been made recently of the potential effects of special conditions like hypnosis on retention and forgetting. Most of these studies have been merely exploratory, and much more evidence is needed before definite conclusions can be drawn.

Hypnosis. Although hypnosis has proved its value to the clinician in enabling patients to remember repressed and long-past experiences, its effect upon the recall of recently learned material seems much more doubtful (Dorcus, 1956). The available evidence, however, is not only meager but conflicting. One recent study, for example, indicates that hypnosis *does* aid in this kind of recall.

The subjects' task was to remember as much as possible about a large number of small objects placed on a table. Among these were useful items, such as a key, a thimble, a screwdriver, and a spoon, and a number of toys, including a train engine, a car, a chair, a cat, and many others.

Differences Between Men and Women in Recall of Partisan Items



Adapted from Alper and Korchin, 1952

Two different tabletop setups were used as control measures. Subjects were divided into four groups. Before they examined the tables, Groups 1 and 2 were hypnotized and given a posthypnotic suggestion to observe and remember, whereas Groups 3 and 4 were not. Two groups viewed one setup first and two viewed the other.

Subjects observed the tabletop for thirty seconds and then were taken to another room and given unlimited time to write out all they could remember about the objects on the table. They did this first in the waking state and then in a hypnotic trance. One week later they were again asked to recall the items, both in a waking state and under hypnosis.

The third week the setups were reversed so that each group viewed a different tabletop; this time Groups 3 and 4 were given posthypnotic suggestion, whereas Groups 1 and 2 were not. In the fourth week subjects were asked to recall—both in a waking state and under hypnosis—first, the material observed the previous week and secondly, the first set of objects viewed. This was done as a test of retroactive inhibition. Subjects received one point each for the name, color, and location of an object, and a "plus point" if they mentioned extra details. Hypnotic recall was consistently superior to waking recall, with an average gain of 5.01 point per individual on scores obtained under hypnosis. The groups that received posthypnotic suggestions to observe and remember did somewhat better on immediate recall but a little worse on delayed recall. The

amount of retroactive inhibition did not seem to be influenced significantly by hypnosis (Sears, 1954).

Contrary to some findings this study suggests that hypnosis can aid both immediate and delayed recall, but more research is needed.

Electroconvulsive shock. As we have seen, shock treatment is commonly used in the treatment of certain mental illnesses. Psychiatrists and psychologists have been somewhat concerned over the possibility that such treatment might have harmful effects on a patient's mental processes. Electroconvulsive shocks do seem, temporarily at least, to have an adverse effect on both retention and relearning.

In a recent study two groups of eight rats were trained in a complex swimming maze. After being allowed to rest for forty days they were given twenty-five trials for relearning the maze. During the last ten days of the rest period, before the relearning trials began, the experimental group received electroconvulsive shock. During the first three days of the relearning period this group was markedly inferior to the controls. However, the experimental group then began to catch up with the controls, indicating that the effects of shock upon retention were not permanent (Stone and Bakhtiari, 1956).

Anoxia. Another physiological factor which has been studied in connection with retention is lack of sufficient oxygen, or anoxia.

In a study of the effects of anoxia on retention, six groups of rats were trained in a discrimination problem. Except for the control group, all groups were exposed to a level of anoxia equivalent to spending ten minutes at an altitude of twenty thousand feet. One group was exposed thirty seconds after the learning task was completed; one after two minutes; and the others after fifteen minutes, one hour, and four hours, respectively. Following a rest period of forty-eight hours, all groups relearned the same discrimination task. Those who were exposed to anoxia within two minutes after completing the original learning showed significant deficits in retention, but the others did not (Thompson and Pryer, 1956).

It has been suggested that anoxia is responsible for the effect which electroconvulsive shock has on memory, but the above study does not support this theory. Much more research is needed to determine just how electric shock does exert its effect on retention.

SUMMARY

Learning is affected both by external factors in the learning situation and by internal factors, characteristics of the learner himself. Learning may be improved by *intent to learn* and by *reward and punishment*, though punishment alone can actually hinder learning. Intrinsic motivation, whether concerned with immediate objectives or *long-term goals and interests*, usually leads to better learning than does extrinsic motivation such as grades.

The effect of *stress* on learning varies with individuals, acting as a strong motivating force for some but causing damaging mental blocks or anxiety reactions in others. *Frustration* results in *stereotyped behavior* and increases learning time, while *group participation* is a strong dynamic factor in learning—particularly in effecting behavior change.

Learning is greatly influenced by the characteristics of the material to be learned—its *amount*, *familiarity*, and *meaningfulness*. *Memory span*—the amount of verbal learning an individual can master in a single presentation—is higher for meaningful material than for nonsense syllables or digits. Both familiarity and organization contribute to meaningfulness.

Psychologists recognize a number of ways in which learning can be made more efficient. One important means is *psychological feedback*, the process whereby the learner gains information about the correctness of his responses so that he can compensate for error. Whether *massed* or *distributed practice* is better depends on the learning task and the stage of learning. Distributed practice avoids the lowered efficiency caused by fatigue or boredom and is superior for rote learning up to a certain level of complexity. Massed practice followed by distributed practice is best for learning ideas and principles; the reverse is true for motor learning. Massed practice is also best for logical reasoning problems, though an incorrect mental set is less likely to develop and persist with distributed practice.

Whole and part learning have their individual advantages, but a combination of the two probably achieves the best results. Prior activity may result in *positive* or *negative transfer*, depending on whether the prior task and the present task have common or differ-

ent stimulus-response combinations. *Verbalization* can be a valuable aid in motor learning.

Although it should not be continued too long, *guidance* can greatly further learning by clarifying principles and establishing correct habits. Guidance remains important when the various audio-visual aids are used. *Films* can hasten learning, though their effectiveness varies. *Television* shows great potential as an aid to learning.

Learning does not occur during *sleep*, but there is some evidence that improved learning may be achieved under *hypnosis*.

Forgetting usually is most rapid immediately after the learning period. If, however, the learning has not been complete, the learner can sometimes remember more at a later time than he can at the end of the practice session. The degree of such *reminiscence* evidently depends on (1) meaningfulness of material, (2) determination to recall, (3) degree of mastery, (4) length of time involved. This phenomenon suggests that forgetting involves dynamic forces that remain active long after the learning situation ends. There is some question about whether anything learned is ever completely forgotten.

The activity that follows learning can either help remembering (*retroactive facilitation*) or hinder it (*retroactive inhibition*). Sleeping results in the least forgetting, and engaging in an activity closely similar to the original learning causes most interference. Material meaningfully organized is not forgotten as readily as nonsense material. Mastery of subject matter becomes more stable the longer it is retained, making less review essential.

Tasks interrupted before completion are more likely to be remembered than completed tasks—the *Zeigarnik effect*—but when stressful conditions are involved, the reverse may be true. Memories which threaten self-esteem often meet unconscious resistance and are conveniently “forgotten,” or repressed. A person tends to learn something faster and remember it better when it agrees with his own attitudes.

Evidence of the effect of *hypnosis* on the recall of recently learned material is conflicting. *Electroconvulsive shock* seems to have an adverse effect, at least temporarily, on retention and relearning. *Anoxia*, too, affects retention if it occurs soon after learning.

CHAPTER THIRTEEN

THINKING

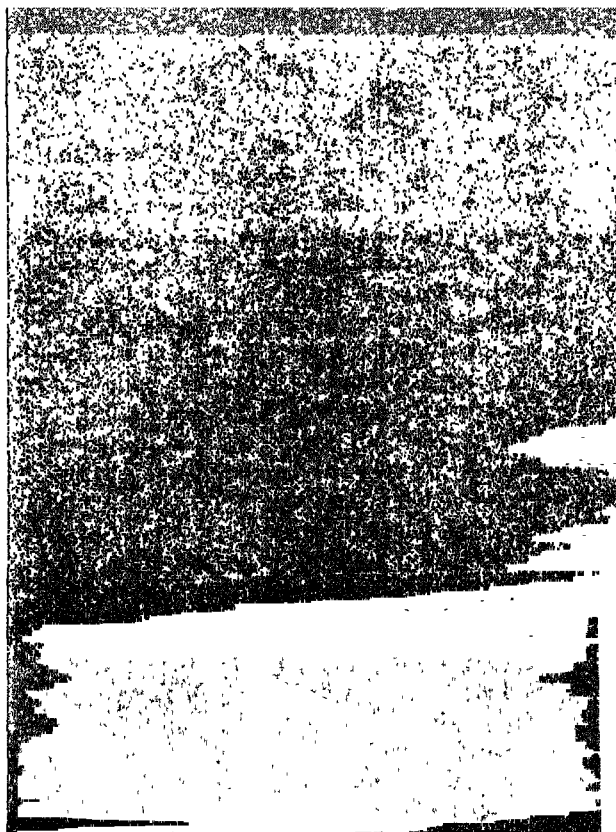
WHAT IS THINKING?

MECHANICS OF THINKING

KINDS OF THINKING

AVOIDING CLOUDY THINKING

CYBERNETICS



Man is greatly superior to the lower animals in his ability to adjust to new situations imposed by environment. This superiority comes partly, as we have seen, from the fact that man has greater learning capacity and therefore is far less dependent upon inborn behavior patterns. In other words, he has greater flexibility of response. Man is further set apart from the lower animals by virtue of his enormously greater capacity to deal with symbols or signs that represent absent objects. Without this capacity he could neither reason nor invent new ways of doing things.

WHAT IS THINKING?

When a chemist looks at a bottle of sulphuric acid, he cannot actually observe its molecular structure. Nevertheless, he can represent this structure diagrammatically and indicate the relationships among the elements in its composition by the symbolic formula H_2SO_4 . By manipulating such graphic and verbal symbols, he can analyze the properties of compounds and predict the reactions which will occur when they are combined with other compounds, the properties of which he has similarly analyzed by symbolic manipulations. This process—using symbols to manipulate implicitly ideas or objects not physically present to the senses—is called *thinking*. The symbols we use are many and varied and include words, numbers, gestures, pictures, diagrams, and visual images.

Actually there is no clear dividing line between thinking and other modes of response. When the chemist in our example looks at a diagram to aid his thinking, perception as well as thought enters into the process. And

as he observes and thinks, he also is learning. Thinking occurs when the individual represents various properties of a situation by symbols and then manipulates or organizes those representations in ways which do not depend upon immediate perceptions or actual physical manipulation of objects.

THE MECHANICS OF THINKING

Over the years there has been much speculation and controversy over the mechanics of thinking, especially about the kinds of symbols necessary for thinking to take place. Some investigators have maintained that thinking requires the use of concepts or language; others that thinking is a manipulation of images; still others that thinking consists of

tiny muscular contractions. Today it is pretty generally agreed that all of these may be involved in thinking.

IMAGERY IN THINKING

A half century ago psychologists were deeply concerned with the role of imagery in thinking. Some investigators maintained that thought required the use of images—mental pictures of actual sensory experiences—whereas others held that thought could proceed in the absence of imagery. Subsequent discoveries have supported the second point of view. In one pioneer study, for example, it was found that many scientists and mathematicians, though engaged in the highest and most complicated type of thinking, were actually quite deficient in visual imagery (Galton, 1883). Less gifted persons and children, on the other hand, often possess clear visual imagery to a much higher degree. Many people report that they can even dream without the use of images. All this is not to deny that imagery is used in many kinds of thinking, but evidently other kinds of symbols may be used instead.

Eidetic imagery. In rare cases individuals possess imagery which is almost like actual perception in its clarity and accuracy. These strong images, usually visual, are called *eidetic images*. People with eidetic imagery can frequently tell the exact position of a formula or fact on the printed page of a textbook. They can even glance for a fraction of a second at an object, such as a comb, and then call up such a vivid image that they can give a complete description, including the number of teeth in the comb. In examinations they “copy” from their image of the printed page, thus keeping within the rules of the game but performing with an accuracy as great as though the book were actually open before them. The following case is illustrative.

A law student was once called before a disciplinary committee on the charge of cheating in an examination. One of the questions called for the details of a law case which was given in the textbook. The student had turned in a description which was word for word that of the textbook. The reader had quite naturally concluded that the student had copied from an open book. Upon being questioned, the student defended himself by saying that he had felt that the professor might call for that case and so had looked

it over just before class. To test his ability at such exact reproduction of verbal material, the student was given a page of unfamiliar material to study for five minutes. At the end of that period he was able to reproduce some four hundred words without error. Not a single word or punctuation mark differed from the text. He had eidetic imagery.

Eidetic imagery is most often found in children. Although it is comparatively rare in adults, it is not a particularly mysterious phenomenon. Careful investigation indicates that eidetic imagery is simply very clear visual memory (Allport, 1928).

Most people seem to be strongest in visual imagery. Some, however, are strongest in their “mind’s ear”; and a small minority report that images of touch, muscle movement, taste, or smell are strongest.

Synesthesia. The translation of sensory experience from one sensory mode to another is called *synesthesia*. The most common example of this condition is when auditory stimuli give rise to visual imagery. There are no absolutely fixed relationships between visual imagery and the nature of auditory stimuli, but the following tendencies have been observed: A rise in pitch or quickened tempo usually brings increased brightness of the image. Smooth music brings graceful, flowing lines in the visual images; syncopated music jagged lines. Different instruments give rise to lines of different color. Increases of volume increase the area of the images.

About 10 per cent of the adult population enjoys such “colored hearing” when listening to music or other sounds. Some people have colored images even when recalling music (Karwoski and Odbert, 1938).

LANGUAGE IN THINKING

The relation of language to thought has long been a subject of interest. Is thinking merely a sort of inner speaking? Or is speaking actually a hindrance to thought?

In ancient times thoughts were ordinarily identified with words and were imagined as being stored in the body. Homer even speaks of them as “feathered creatures” in the chest (Cohen, 1954). Children, too, often connect thoughts with speech.

A little girl described by Piaget had lost her doll, and when asked if she had any idea where she put

it, she replied, "No, I've no more ideas in my tummy. My mouth will have to give me a new idea." "Why your mouth?" asked Piaget. "Yes, it's my mouth that gives me ideas," said the child. "It's when I talk, my mouth helps me to think." Three weeks later she commented that it was possible to have ideas even when your mouth was shut, but you couldn't say them, for they were still in your tongue (Piaget, 1951).

On a more sophisticated level, many philosophers and poets have felt that thought is inseparable from language, agreeing with Wordsworth that "the word is not the dress of thought but its very incarnation." Others including Shelley, the master artist with words, have felt that words are an impediment to thought. In this group too, are many scientists—among them Galton, who felt that he had not grasped a problem unless he could "disembarrass it of words" (Cohen, 1954).

It has been shown that speech is not necessary to the formation of concepts.

When a cigarette (an object chosen because it had small, if any, value as a reward) was placed under one of two different colored slips of paper, children too young to talk and aphasics (persons who had lost the power of speech as a result of injury) were able to learn the proper color of the slip as well as those with speech ability. However, they were not as able to apply the concept to situations involving different colors. When the rule was purposely upset to cause distress to the subjects, those who could speak seemed able to forget the disturbance more readily (Eliasberg, 1954).

But though words are not essential and may sometimes even be a hindrance to thought, speech appears to be an aid in solving most problems. Indeed, few of us would want to try to think without it. Perhaps the intimate relationship between words and thoughts has been accurately expressed in the simile of Sir William Hamilton, who compared the use of language to the operation of tunneling through a sandbank:

"In this operation it is impossible to succeed unless every foot, nay, almost every inch in our progress be secured by an arch of masonry when we attempt the excavation of another. Now, language is to the mind precisely what the arch is to the tunnel. The power of thinking and the power of excavation are not dependent on the words in the one case, on the

masonry in the other; but without these subsidiaries, neither process could be carried on beyond its rudimentary commencement" (Hadamard, 1949).

As human culture has progressed, a great host of verbal symbols have been developed to facilitate the solution of problems which would be much more difficult to cope with if the individual had to rely on the direct manipulation of objects and images. The development of such symbolic systems as algebra and calculus, for example, has greatly increased man's ability to control his environment. If a surveyor wishes to determine the height of some tall landmark, it is not necessary for him actually to scale the object and measure it directly. Instead, he can set up a sextant at some specified distance from the base of the landmark and measure the angle of elevation from that point to the top of the object. Then, by merely manipulating certain mathematical symbols, he gets his answer.

The verbal symbols we use in thinking do not, of course, possess the rich detail of the objects and events which they represent; and evidently our thought processes, too, go beyond them. This can be clearly seen in the case of a small child whose vocabulary is still highly restricted. A two-year-old child has no trouble at all in distinguishing his own mother from other women, but he will tend at that age to refer to any woman as "a mommie." He does not yet have the abstract concept "woman."

Another interesting example was given by a small child presented with one of the test items from the Stanford-Binet test. The child had been given a card bearing ten geometric designs. Then he was handed a sample of one of these drawings and asked to find the one like it on the big card. In the case of three of the ten drawings his comment was the same—"There's a ball." But in each case he matched the drawing correctly—a circle with the circle in one case, an ellipse with the ellipse in another case, and an octagon with the octagon in the third case. His behavior, in other words, was guided by some process more precise than his expressed verbal reactions.

Concepts in thinking. (The first meaningful words which the child uses stand for single, concrete objects. He will use the word "dog" or "kitty," for example, in reference only to the family pet or some other specific animal. As

a next step he will learn to group *many* individual animals into the categories of "dog," "cat," "cow," "horse," and so on. Still later he will learn to group all these animate objects under the single unifying concept of "animal." This process of developing *concepts*—of learning to group objects in terms of some distinguishing common property—is called *abstraction*. As a person progresses toward maturity, he develops and uses concepts at higher and higher levels of abstraction—concepts such as "truth," "beauty," "right," and "wrong."

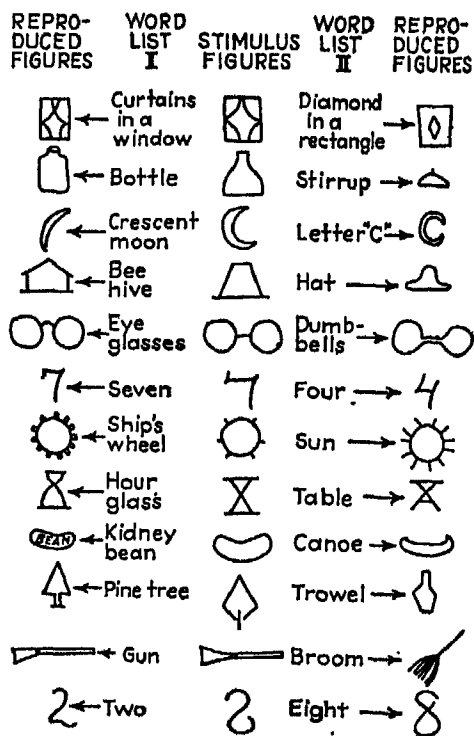
To test whether a child has formed a particular concept, we simply present him with unfamiliar objects which possess the distinguishing characteristic. For example, to test whether a child who has learned to call grass "green" actually has acquired the concept of "greenness," we present him with various un-

familiar objects, some of which are green and others which are not. We conclude that he has formed the concept of "greenness" if he can apply the label "green" to the correct objects. Often a child who does not know the verbal label will indicate by his *actions* that he has formed a concept—that is, that he is aware of distinguishing characteristics.

The first concepts which the child forms are based on visual similarity between various objects. As he grows older, however, the child learns that some things are grouped together which have little or no outward similarity—for example, that dogs and fish and earthworms and birds are all "animals." He must also learn to make distinctions between various things whose superficial characteristics are very similar. From the biologist's point of view, for instance, whales have more in common with dogs than they do with sharks, because whales and dogs are warm-blooded (maintain a constant body temperature) whereas sharks are cold-blooded (tend to maintain the same body temperature as their surroundings).

Much of our education—formal and informal—consists in learning to employ abstract concepts. Such concepts as those represented by the terms "mass," "velocity," "energy," "time," "distance," and "inertia" are essential to an understanding of physics. And throughout this book you have encountered some of the fundamental concepts of psychology, such as "maturation," "learning," "emotion," and "intelligence." Comparable technical terms are employed in all sciences and in every type of accurate thinking because the concepts they represent are precise—the limits have been sharply drawn and agreed upon by experts in the field, so that the meaning of the term is clear to everyone who uses it. Such concepts are always derived ultimately from primitive, sensory experience with existing things, but they represent no one thing capable of independent existence.

Many other concepts, equally abstract and equally important in much of our thinking, are much less precise than those of science. Your concept of "right," for example, is the product of innumerable experiences at home, at school, at church, and as the member of various social and political groups. It may be quite different from that of someone reared in a different culture or even a different home. Indeed, your *own* concept of "right" is



The potent influence of language and concepts on both perception and memory is graphically shown in the figures above, obtained in an interesting experiment. The stimulus figures were presented with Word List I to one group of subjects and with Word List II to a second group. Later, when the subjects were asked to redraw the figures, the results in each case were more like the named object than the original figures had been (Carmichael, Hogan, and Walter, 1932).

probably undergoing a continuous process of modification and development.

Because concepts of this sort are derived in good part from subjective experiences, they are necessarily less precise than the scientist's concepts of "energy" and "mass." Yet the general processes by which these various concepts are formed is probably much the same.

Forming concepts. The process of concept formation through abstraction of some element common to a class of objects has been studied in the laboratory for many years. An early experiment, but by no means the earliest, made use of Chinese characters.

College students were shown a series of thirty-six Chinese characters which, unknown to them, fell into six "families" of characters; all the items in each family had some common identifying element. Each character was followed by a sound which was the same for all the characters in that family group and was never used with characters from another family. For example, the character 沛 was presented with sound oo; the character 祖, with sound yer; the character 梁, with sound fid; and so on. Characters possessing the six different elements (and followed by the corresponding sounds) were presented in random order.

The subjects were not told the true nature of the experiment—that it involved the abstraction of concepts representing common elements. They all thought that they were doing a memory experiment. Their instructions were to name the character, by giving the sound that he had presented with it, before hearing the experimenter give it at the end of the two-and-a-half second period of exposure of the character.

When the subject could give the proper sound for each character in six trials, he was tested with entirely new characters possessing the same common elements that he had learned to name before. This was done to see if the common element had in fact been abstracted.

Eventually most of the subjects learned that whole characters such as the following, all called oo, had a common element: the "check mark with two half-moons in it."

津 咏 梁 港

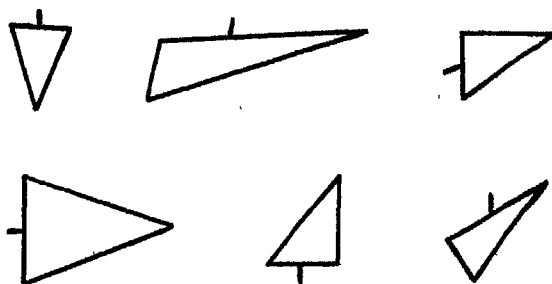
Analysis of each subject's results showed that "individual concepts usually came into consciousness very gradually. Erroneous first impressions were either discarded or transmuted into the correct form

by a continuous development. Trial and error plays, if not a dominant, at least a very important role in the process."

The author's objective in this experiment was to determine principles which govern efficient learning of concepts. He found that the most effective method among several tried was to present the series of characters with the common element drawn in red so that it would stand out. His conclusion with regard to concept formation was labeled "the principle of dissociation" and is stated in the author's own words as follows: "What is associated now with one thing and now with another tends to become dissociated from either, and to grow into an object of abstract contemplation" (Hull, 1920).

As has been suggested, several lines of evidence indicate that naming is not essential to the abstraction of a common element.

In an experiment using figures such as those shown below, it was found that subjects could often classify the objects on the basis of their common elements long before they could explain to some other person the principle involved—actually tell how they did it.



The task was to distinguish between "Mibs" and "Non-Mibs." A "Mib" was a triangle with a line extending at right angles from its shortest side (Smoke, 1932).

Much of the questioning that is so characteristic of children is a help to them in forming and sharpening their concepts. The following conversation between a mother and her child of four and a half is typical of this process (Rust, 1947).

Child: I'm four, aren't I?

Mother: Yes, four years.

Child: What's a year?

Mother: (Explains)

Child: Is that a long time?

Mother: Quite a long time.

Child: How long?
 Mother: It's hard to explain, but it is a lot of days, 365, and that's many.
 Child: Well, but how long?
 Mother: Well . . . you know when it was Christmas.
 Child: Oh, yes, and I had a tree, and once I had the tree in the corner, and once I had it on the table.
 Mother: Well, that was twice, and it takes a year to have a Christmas. You see we have Christmas, then the time between that Christmas and the next is a year.
 Child: Well, that's a very long, long time. When I was very small we had a Christmas. Is a year a birthday?
 Mother: Well, you have one birthday, then the time between is called a year, then you have the next birthday.

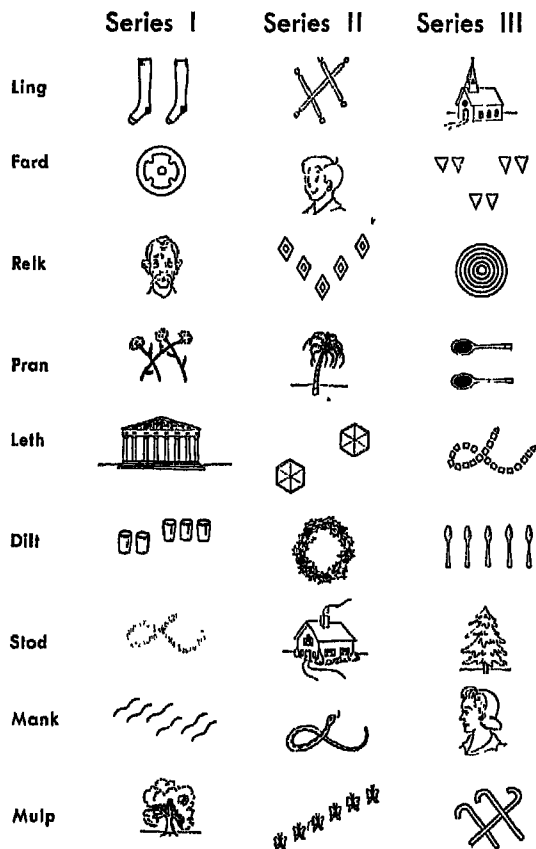
Child: Yes, three then four—then five . . . say, how old are you?
 Mother: Thirty.
 Child: How did you stretch up?

Studies of such conversations give us some indication of the way children develop abstract concepts and are helpful in suggesting problems for closer study, but their results are not dependable because there is not sufficient control of past experience. The following study on the development in children of the concept of *roundness* illustrates the care with which experiments on concept formation must be planned if we are to arrive at sound conclusions.

The apparatus consisted of two identical compartments in which stimulus objects were placed. As long as the compartment was lighted from the inside, the stimulus objects were visible through a mirror-screen on the front of the compartments. Each compartment also had a hole in its base out of which a piece of candy could come when the mirror was pressed.

Each subject was brought into the room alone and allowed to play with the apparatus. If he pressed the mirror of the compartment containing the positive stimulus, the lights went off and the piece of candy rolled out as a reward. If the mirror was not pressed spontaneously by the child, which it usually was, its action was demonstrated by the experimenter.

After the subjects had learned to select the positive stimulus (always a ball of some sort) instead of the negative stimulus (never a ball), they were tested on a variety of objects to see if the concept of roundness had been formed and would function to guide selection from pairs not previously presented. The following results were obtained: (1) All subjects gave evidence of having established a concept of roundness by selecting the spherical object more often and by selecting it first from a pair of objects not used in the training. (2) In eleven of the thirteen subjects the concept of roundness was broad enough to include cylindrical as well as spherical objects. (3) It also included the more nearly round pairs of objects neither of which was perfectly round. (4) The older children learned the concept more rapidly than did the younger ones, and those of higher mental age learned more rapidly than those of lower mental age (Long, 1940).



These drawings were used in an experiment on concept formation by adults (Heidbreder, 1946). The nonsense syllables—Ling, Fard, etc.—represent concepts, illustrated by the figures in Series I. Can you give the correct names for the drawings in the second column? In the third? When finished, see page 356.

Other careful experiments of this sort, employing subjects of all ages and covering a wide variety of concepts, are needed before we can round out our understanding of how concepts are formed.

Language structure and thought. Another problem concerning the relation of language and thought is the question of how much the structure of our language determines what we think. One student of language and culture, Benjamin L. Whorf, has proposed the theory that language patterns, operating unconsciously, play a dominant role in making a person conform to his culture. For example, we have seen in our discussion of time perception that some primitive tribes have only one tense for the verbs in their language and thus speak of everything as occurring in the present. It would seem impossible for anyone who spoke that language to have the same concept of past and future time as we have. In the same way, Whorf believes, language patterns determine the course of other aspects of thought and even affect perception.

In general, the Whorf theory is regarded as a valuable tool for cross-cultural understanding. However, a number of anthropologists feel that the concept of language as the predominant factor in culture represents too extreme a position. They criticize Whorf for taking too little account of the development process and the mental activities that go on before language exerts much influence on the individual (Fearing, 1954).

The Whorf hypothesis also involves the deeper question of what inherent qualities, if any, cultural influences operate on. Further research on cultures which are very similar but have totally different language patterns or which have similar languages but differ markedly in other respects may throw needed light on the whole question of the relationship between language patterns and thought (Hoijer, 1954).

MUSCULAR ACTIVITY IN THINKING

Many lines of experimental evidence have demonstrated that thinking is accompanied by muscular contractions. These are so minute that they can be detected only with the aid of a sensitive apparatus which picks up the small but measurable electrical impulses (or *action currents*) produced by contracting muscles. The tiny muscular contractions which occur during thought are called *implicit* speech or gestures.

In one experiment, while records were made of the action currents of the muscle and skin at his right

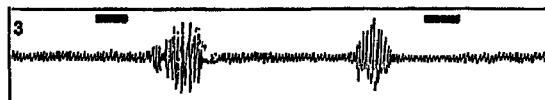
elbow, the subject was told to think of several different actions. At first he was told, "Upon hearing the first signal, imagine lifting a ten-pound weight with the right forearm. Upon hearing the second signal, relax any muscular tensions, if present." The results are shown in the record below, with the experimenter's signals indicated by the short bars at the top.



Then the subject was instructed: "Upon hearing the first signal, imagine lifting the weight with the left forearm." The results are shown in the record below, which is similar to that obtained from the instructions, "Do not bother to imagine," or "Imagine bending the right leg."



The following record of muscular action currents was obtained following the instructions, "Imagine hitting a nail twice with a hammer held in your right hand" (Jacobson, 1932).



Similar results have been obtained by many other experimenters. In one study, for example, it was shown that when a person is thinking of a geometric design, his eyes move to form the outline of it (Totten, 1935).

"Talking to himself" is an expression commonly applied to a person who is engrossed in deep thought. Psychological evidence indicates that this expression may be not only figuratively expressive but also scientifically accurate. Various investigators have studied this problem by fitting sensitive recording apparatus to the lips, tongue, and voice box.

In one such study subjects were instructed to read poetry or other material to themselves silently. Most of the subjects showed movements of the speech apparatus which were too small to be detected by the unaided eye but still large enough to be picked up by the sensitive recording apparatus (Thorson, 1925).

Although such implicit movements are possible carriers of meaning, it is not known whether they are a cause or an effect of thinking.

Further understanding of the role of implicit muscular activity in abstract thinking is gained from a highly interesting experiment investigating whether deaf-mutes make tiny "speech" movements with their hands during thought, comparable to the tiny movements of the vocal apparatus that normal people make.

Subjects of the study were sixteen persons with normal hearing and eighteen persons who were deaf. It might logically be expected that deaf persons, who make greater use of gestures in communicating with each other than do persons with normal hearing, would also make greater use of small muscular movements while engaged in abstract thinking. It turned out that in abstract thinking, such as multiplying and dividing mentally, the deaf subjects showed measurable action currents in the arm muscles in 84 per cent of cases, as against 31 per cent for the normal subjects. However, when normal and deaf subjects were instructed to imagine that they were performing tasks which would require the use of their arm muscles, the percentage of electrically measured small muscle movements of the arms was the same for the two groups (Max, 1937).

Here again the facts are consistent with—though *not* conclusive evidence for—a motor basis of thought. There is no doubt that thinking of some act is correlated with action currents in the muscles that would be used in that act. This is true regardless of whether images are present. However, we still lack fully acceptable evidence of the direction of *cause* and *effect*. Logically, it is as possible that the thought causes the implicit movement as that the implicit movement causes

the thought. The fact that subjects in the above experiment were unable to imagine while relaxed is consistent with the interpretation that tiny muscle movements are essential to thinking, but it is not conclusive proof. The time sequence of the two things must be established before we can be sure.

Individuals who have undergone a five-minute period of inhibition of muscular activity by "freezing" in an awkward position see significantly more than the normal amount of motion in the Rorschach cards (Singer, Meltzoff, and Goldman, 1952). In other words, they tend to describe figures in the act of howling, climbing, or performing some other muscular activity. The same study showed no difference in the number of motion responses given by subjects after five minutes of vigorous calisthenics, as compared to the number given on the initial, or control, administration of the test. However, brain-injured children, who are more active than normal children, give significantly fewer motion responses on the Rorschach (Werner, 1945). They also have difficulty in perceiving movement when two pictures are presented in rapid succession to give the illusion of motion (as in a movie). Further research in this area is needed in order to clarify the relationship between motor activity or motor inhibition and the capacity for creative imagination.

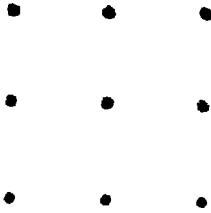
THE CONTEXT OF THINKING

All our thinking takes place within a *context*, which includes what we have learned from past experience, our motives and attitudes, and our particular "set" at the moment (Johnson, 1955). Context acts as a selective and regulatory mechanism which influences the direction of all our thought. Thus thinking—like perception and learning—is to some extent *personalized*; our own particular background of motives, experience, and beliefs gives us each a somewhat unique framework within which our thinking takes place.

Numerous experiments with reaction time, perception, learning, recall, and problem solving have shown the importance of "set" in determining response. If the experimenter instructs his subjects to cancel out all the O's in a stanza of poetry, the subjects may not notice what the poem is about; or, if he tells them to memorize the poem, they probably will not notice such other things as whether

The drawings on page 354 were used to determine adult readiness to attain concepts of spatial forms, concrete objects, and numerical quantities.

Spatial forms:	Fard	○
	Stod	∫
	Pran	✕
Concrete objects:	Relk	face
	Leth	building
	Mulp	tree
Numerical quantities:	Ling	2
	Dilt	5
	Mank	6



Without lifting your pencil from the paper, connect all nine dots by drawing four straight lines. The solution is on page 359.

the page arrangement is artistic or whether there are more O's than A's in the lines. In other words, what we perceive, learn, or think is greatly influenced by what we are "set" for. Such processes of selection and regulation are always going on, even though we may be unaware of them.

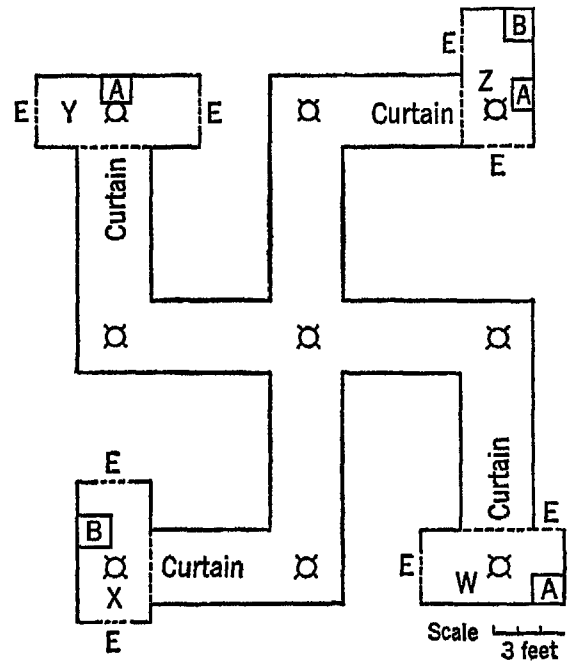
A mental set may help or hinder us, depending on whether it directs us toward or away from a desired goal. For a simple example of this, try to figure out the above problem. Many problems both in the laboratory and in everyday life seem temporarily insoluble because we approach them with an inappropriate set.

KINDS OF THINKING

The kinds of thinking we do range between two extremes. *Realistic thinking* is determined primarily by the requirements of the external situation; *autistic thinking* is determined primarily by our own needs and wishes and feelings. Realistic thinking tends to be productive—to be directed toward action or the solution of a problem. Autistic thinking, on the other hand, tends to be indulged in for self-gratification without necessary regard to reality.

AUTISTIC THINKING

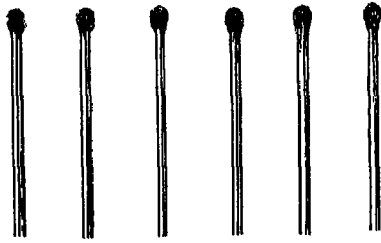
Fantasy, dreams, and wishful thinking are all examples of autistic thinking, which is thinking as an end in itself and not as a means to an end. A little dreaming by day or night may be good for us. Some inventors and artists have reported that a significant idea first came to them in a dream and then was evaluated and elaborated in a waking



The apparatus diagrammed above was used by Maier in an experiment to test children for reasoning, which the experimenter defined as the ability to combine the essentials of two isolated experiences in such a manner as to achieve a goal. In the diagram, W, X, Y, and Z mark booths at the ends of the pathways. (They are separated from the paths by curtains.) E marks curtained entrances and exits; A, an adult's chair; B, a child's chair. The position of lights is also indicated.

The child was first allowed to explore the apparatus to become familiar with its various parts and then was removed by the experimenter via a predetermined booth, such as Y. He was led around the apparatus by a devious route to another booth, W, where there was a toy windmill which played music and turned when a penny was dropped into the chimney. To test the subject's reasoning ability, the experimenter took him to another booth, X, gave him a penny, and told him to look for the windmill. The child could not go directly to W from X unless he integrated the two isolated experiences—general knowledge of the apparatus and knowledge of where the windmill was (Maier, 1936).

state. As a rule, however, our dreams and fantasies do not stand up very well in the light of everyday reality. What seems like a "spark of genius" on awakening may be found upon examination to be a very poor idea indeed.



One test of problem-solving ability requires the subject to make four equilateral triangles from six match sticks (Duncker, 1945). The solution is on page 360.

Often a person who is dissatisfied with his everyday life has daydreams of success and gratification. These sometimes become so satisfying that the individual no longer seeks real achievement. We can see this mechanism operating in its most extreme form in the delusions of grandeur common to many schizophrenics. For them the world of fantasy appears real.

Most of our thinking is probably shaped somewhat by both inner and outer determinants; our reasoning is notoriously subject to distortion by our wishes and prejudices, and our daydreams may be prompted by problems that are quite real and accurately perceived. The creative imagination of the scientist or inventor represents an application of highly imaginative thinking to the service of reality.

REALISTIC THINKING

Contrasting with autistic thinking is realistic thinking, which helps us to adjust to the real world. It takes place when we use facts and concepts to solve specific problems.

Solving problems. As we saw in Chapter 11, problem solving may be based on random trial-and-error behavior with no evidence of thinking. This seemed to be essentially the case in the early experiments with cats whose problem was to escape from puzzle boxes. On the other hand, in many cases of animal problem solving there has been evidence that the solution resulted from implicit trial and error, the manipulation of symbols rather than real objects—that is, that it depended upon *thinking*. For example, in some experiments animals have suddenly used boxes or sticks in new ways to solve a particular problem such as reaching an object which was not

immediately accessible. In delayed reaction experiments, too, animals have been able to remember which of several containers held a reward—an accomplishment that must depend upon their using symbols of some sort.

The occurrence of thinking in the solution of a problem seems to depend not only upon the inherent “thinking capacity” of the animal or individual involved but also upon the type of problem—that is, whether it involves intrinsic relationships or meanings that the subject *can* discover through thought. Dogs and cats sometimes show considerable ingenuity in figuring out how to get what they want, whereas a college student facing a multiple-choice test that is too hard for him may rely primarily on blind guessing.

Studies of problem solving in human beings have used problems of several types—mathematical problems, mechanical or “tool” problems, and practical problems or puzzles of various kinds. All of them require some degree of thinking.

There have been many attempts to describe reasoning, problem solving, and creative thinking in terms of steps or stages. For example, both problem solving and artistic creation have been described in terms of four stages: *preparation*, *incubation*, *illumination*, and *verification* (Wallas, 1926). A more recent formulation describes problem solving as made up of the following processes:

1. Apprehension or recognition of the problem, together with effort to deal with it
2. Some manipulation or exploration of the situation
3. Some degree of control, or direction, of performance
4. The understanding or mastery of intermediate requirements or steps
5. Emotional responses representing some degree of personal involvement in the situation (Vinacke, 1952)

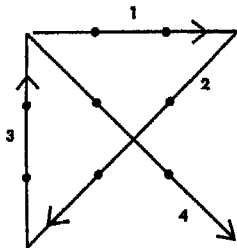
These and other formulations for problem solving (Dewey, 1933) and creative work (Patrick, 1937) are so comparable to one another that we can fuse them into the following account:

1. *Becoming concerned about or interested in a problem.* Thinking must satisfy a need; the person who is completely satisfied will not think. There must be some need—whether the recognition of the lack of some practical labor-saving device or a felt urge to create some esthetically satisfying piece of music.

2. *Assembling the materials with which to work.* The problem-solving thinker must examine closely the situations with which he is concerned. Why are the machines now available inadequate, and what are the areas in which trouble most often appears? The creative artist has a similar period of preparation. Sometimes after a period of concentration on the requirements to be met, the inventor or artist will purposely turn his attention to something else. Such an interlude may serve him as an "incubation" period, and when he returns to his problem he may find that new ideas have crystallized.

3. *Deriving a number of possible solutions.* While a person is thinking about the problem, working with the materials he has assembled, various possible ways of solving the problem may occur to him. Sometimes these solutions come so suddenly and so dramatically—so adequately—that the thinker is inclined to think of them as "inspirations" or "illuminations." This seems to occur particularly with artists, but the process is not really different from what has been reported by scientists who have been curious about their own thinking processes. It must be remembered that the technically trained worker (whether mathematician, poet, or musician) has put an enormous amount of time and work into mastering the "tools of his trade"—into achieving an easy skill in all the subprocesses which would have to be performed most laboriously, if at all, by a novice in that field.

4. *Evaluating the suggested solutions.* Further data pertinent to the suggested hypothesis are recalled and used as a standard against which the hypothesis is checked. Frequently this procedure will be sufficient to justify discarding the first hypothesis. In this



Above is the solution to the problem on page 357. The problem is difficult for most people only because they have an unconscious set against going outside the boundaries of the figure.



THE MAN WITH THE HOE

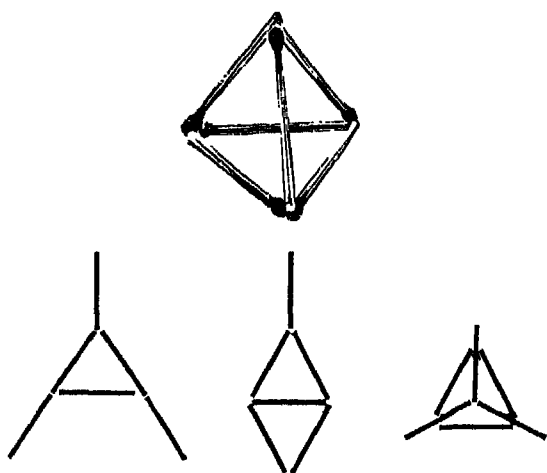
Edwin Markham

"God created man in His own image, in the image of God created He him."

Bowed by the weight of centuries, he leans
Upon his hoe and gazes on the ground,
The emptiness of ages in his face
And on his back the burden of the world.
Who made him dead to rapture and despair,
A thing that grieves not and that never hopes,
Stolid and stunned, a brother to the ox?
Who loosened and let down this brutal jaw?
Whose was the hand that slanted back this
brow?
Whose breath blew out the light within
the brain?

Reprinted by permission of Virgil Markham

When Edwin Markham first came upon Millet's painting, "The Man with the Hoe," in a museum, he was so deeply impressed by it that he stood in front of it, completely absorbed, for two hours. He had no thought, so far as he could remember later, that he might try to write a poem about it, but actually he had already taken the first steps toward creating. His gathering of material had begun long before he saw the painting, however; throughout his life he had been developing the emotional and intellectual interests which made him responsive to that painting and able to write the poem.



At top is the solution to the match stick problem on page 358. Most people find this problem difficult because they begin working in terms of a plane model and never switch to thinking in terms of three dimensions. Their failure to consider the three-dimensional approach may stem from the fact that other familiar match problems have been worked out on a plane and that matches are not naturally suited for three-dimensional building. Various trial solutions (as indicated by the other sketches) might, however, suggest the correct three-dimensional solution to some people.

case another hypothesis is suggested from past experience with related problems, and it in turn is subjected to evaluation in terms of the known facts.

5. *Objectively testing and revising the solution.* Details often have to be changed in artistic work in order to iron out the rough spots. In scientific work and in practical life, too, tentative solutions must be subjected to some careful tests before they are accepted for practical use. The layman often is impatient because new medical discoveries are not immediately applied in practical medical work, but the physician knows that hasty applications may have unforeseen ill effects.

The following description of an attempt to discover the reason for a certain kind of behavior in robins is an example of how these fundamental steps are used in problem solving.

Step 1 (*Problem*). Why does the robin cock his head to one side before pulling a worm out of the earth with his bill?

Step 2 (*Data*). Observation of a large number of robins shows that they all behave in the same way,

namely, cock their heads to one side before pulling out the worm. Observation shows that robins have eyes and ears, and that they eat, sleep, run, walk, fly, and do about all the things expected of birds.

Step 3 (*Hypothesis*). Maybe the robin is listening for the worm.

Step 4 (*Evaluation*). There is not much about a worm to make a noise, because his body is soft and he pushes the dirt around him quite slowly. Any sound made would be very low both in intensity and in pitch. It is unlikely that a robin could be hearing the worm.

Step 3' (*Hypothesis*). Maybe the robin is looking.

Step 4' (*Evaluation*). The robin, unlike the human being, has eyes at the sides of his head. Unlike man who has eyes in front and looks straight at something he wants to see, the robin would be likely to turn its head to focus. Even though worms do not make much noise, they do cause tiny movements of the earth which could be seen. (This solution is judged to be satisfactory.)

Step 5 (*Verification*). An experiment is conducted in which blind and deaf robins are observed and the conclusion is confirmed.

Actually, these processes are blended and interwoven in most problem solving. Often they occur together and tend to be phases rather than sequential steps. The processes of preparing and assembling materials may continue almost to the end, whereas those of formulating hypotheses, evaluating, testing, and revising may occur and continue almost from the beginning. Furthermore, solution of the main problem often means solution of several subproblems, each of which requires preparation, hypotheses, evaluation, and verification.

A V O I D I N G

C L O U D Y T H I N K I N G

All of us have observed that *other* people's thinking is sometimes affected by rationalization, preconceptions, flattery, propaganda, selfish interests, and so on. And if we are honest with ourselves, most of us admit to occasional doubts about the clearness and objectivity of our own thinking.

Some of the tricks we play on ourselves are beyond our control. In some cases pro-

longed psychotherapy is necessary even to bring them to light. But there are many times when knowing about the probable causes of distortion in thinking can help us to avoid their influence.

FACTORS THAT HELP OR HINDER EFFECTIVE THINKING

Many factors help determine the effectiveness of our thinking and problem solving. Among them are our level of intelligence, the difficulty of the problem, our past experience, our flexibility and imagination, our freedom from stress or anxiety, and our attitudes and beliefs. We cannot completely cover this broad subject, but the following reports some of the important research in this area.

The role of past experience. Studies have shown that once a chimpanzee has learned to distinguish between two stimulus objects and to expect a reward if he chooses a certain one, regardless of its position, he may be able to solve a comparable problem with two *new* stimulus objects without further trial and error. If he tries the right object the first time in the new situation, he stays with it on later trials; if he guesses wrong on the first trial, he apparently knows at once that the other object is the correct one, for he chooses it on the next trial and consistently thereafter. The original experimental situation has apparently taught him a generalization—that the same one of two objects will consistently hide a reward (Harlow, 1949).

In solving many new problems we use concepts and generalizations that we have formed in situations that are similar or relevant to the present one. Some "new" problems, in fact, can be solved entirely by the application of past learnings. Others require that we work out new concepts or discriminations.

In general, the greater an individual's relevant experience in a given field, the more concepts and generalizations he will have as useful tools for solving new problems in that field. Thus we expect a mathematician to solve mathematical problems more easily than a nonmathematician and an architect to do better than the rest of us in solving an architectural problem. Often we cannot even understand the problem itself unless we have had relevant past experience.

Mechanization (rigidity). Sometimes, however, past experience may actually hinder us

in problem solving. One way this happens is through *mechanization*—a rigid continuation of behavior which has been successful previously but which for one reason or another is inappropriate to the present situation.

This type of hindrance in problem solving was illustrated in a study conducted on 2709 subjects, including students in high schools, colleges, and adult education courses. Subjects were asked to solve a series of problems dealing with the measurement of water, such as: "Given three jars—A holding 21 units, B holding 127, and C holding 3—how would you measure 100 units of water?" The solution would be: "B jar minus A jar minus two C jars gives the required amount."

After working a simple introductory problem, the experimental subjects worked five "set-producing" problems for which this formula gave the answer. Then they were asked to solve two "crucial" problems which could be solved either by the formula or more simply by using only two jars. A problem which had to be solved by using only two jars, followed by two more "crucial" ones, completed the series. A control group solved only the introductory problem and one of the "set-producing" problems before tackling the rest of the list. Half of the experimental group were told, "Don't be blind," and asked to write these words at the top of their papers as a reminder. The other half, or "plain experimental group," were not told this.

Each college or adult class and each public school which took part in the experiment comprised a subgroup, including both types of experimental subjects and controls. Results were reported by subgroups. In half of these subgroups over 75 per cent of the plain experimental subjects solved the crucial problems by the longer, set-produced method. In every subgroup at least 50 per cent of them did so. On the problem which could be solved only by the simple use of two jars, 50 to 90 per cent failed to find a solution. The "Don't be blind" group had considerably better success on this problem and showed fewer "set" responses to the two problems following it, although about 50 per cent of them had followed the set formula on the first two crucial problems. The control groups solved the crucial problems by the simpler method in all but a few cases in the public school group. Analysis of these results by group showed little or no relationship of age, intelligence, or educational level to the results (Luchins, 1942).

Such hindrance from past experience may be only a matter of the particular set established just prior to the critical problem, as in

this water-jar experiment. Or it may be that long-term habitual ways of behaving keep us from seeing new possibilities. We may be familiar with all the elements needed for a new solution but be unable to organize them in new ways. This helps explain why an "outsider" can sometimes suggest solutions that have not occurred to those involved with the problem.

Functional fixedness. Another way in which past experience may hinder us in problem solving is through *functional fixedness*—inability to see a new use for a familiar tool.

To demonstrate this phenomenon, subjects were presented with a variety of problems. One was to mount three candles vertically on a screen, using three pasteboard boxes, matches, and thumbtacks. The solution was to mount one candle on each box by melting wax on the box, sticking the candle into it, and then tacking the box onto the screen. A second problem required the subjects to suspend three cords from a board. Among the objects presented were two screw hooks and a gimlet, from which the cords were to be hung. In another problem the subjects were to attach four small black squares to a large white one which was then to be attached to an eyelet in a beam. They were given paper clips to attach the squares together and one clip bent like a hook with which the large square could be hung. For the experimental group, one object necessary to the solution of each problem was given a prior use. In the first problem, for example, the candles, matches, and tacks were presented in the boxes, whereas the control group was given empty boxes. In the second problem the gimlet was used to start the screw holes, which were already bored for the control group. In the third problem the black and white squares given to the control group were already attached with glue.

Solutions to the problems were almost twice as easily found when the necessary objects had not previously been given a different use (Duncker, 1945).

These findings were later confirmed by another psychologist (Adamson, 1952).

Reducing rigidity and functional fixedness. Fortunately, there seem to be ways of overcoming or lessening the tendency toward rigidity and functional fixedness in approaching new problems. One way is to introduce a time lapse.

To test the effect of ample time on degree of functional fixedness, two investigators asked psychology

students to construct an electric circuit from a drawing. Half of them had to use a small relay in their construction, whereas the other half used a microswitch. Later they were given the problem of tying together two strings which hung from the ceiling and which were too far apart to be held by the subject at the same time. The solution was to hang a small weight to one string and swing it like a pendulum so that it would swing close to the other string and could then be tied to it. A switch and a relay were the objects available for use as weights. A previous experiment had shown that subjects who had used the relay in the electric problem nearly always chose the switch as a weight, and vice versa, indicating functional fixedness (Birch and Rabinowitz, 1951). In the present study various intervals—one minute, half an hour, one hour, one day, and one week—were allowed to elapse between the two problems. After one minute or half an hour, 70 per cent used the object not previously used in the earlier problem; after one hour, 65 per cent; after one day, 53 per cent; and after one week, 50 per cent. Thus functional fixedness decreased with time (Adamson and Taylor, 1954).

Rigidity may also decrease when there is ample time to consider a problem, as indicated by another study dealing with the water-jar problems already described.

In this experiment varying delays were introduced for the "crucial" problems—those which could be solved by either the long or the short method. The subjects could not begin writing the solution to a problem until a certain length of time had elapsed after it was written on the blackboard. Those who had a delay of ten seconds gave the greatest frequency of rigid solutions and also used concrete aids (figured on a scratch pad) more than the others did. The twenty-second-delay group gave significantly fewer rigid responses and used the scratch pad less. Those who delayed thirty seconds or sixty seconds gave the fewest rigid responses and used concrete aids least often. There was little difference between these last two groups, indicating that thirty seconds was a sufficient delay for this type of problem (Rokeach, 1950).

This finding is corroborated by the study cited in the preceding chapter which showed that spacing practice periods tends to lessen a stereotyped approach (page 381).

One of the important functions of a teacher is to help students overcome or avoid rigidity and functional fixedness by having them look

for the key factors in a given problem. The instructions "Don't be blind" in one of the studies described above had this effect—that is, it alerted many subjects to look for new relationships. A good teacher will usually be much more specific in pointing out the special requirements of a new situation and will also help students to see which concepts and skills from their previous experiences might be helpful in the new situation and which ones might be confusing.

Another way of freeing thought from rigid patterns has been developed by Osborn, a practical psychologist who has been concerned with increasing individual and group creativity (Osborn, 1953). He recommends dividing the process of thinking of solutions into two stages. In the first, known as the "green light" stage, the person tries to free himself of all inhibitions and to be completely uncritical. He should be free to think of anything at all that is related to the problem, whether it seems practical or not. All the hypotheses that occur to him are written down, in case even the most "far-fetched" of them may have some element that can be put to practical use. If several people are working together as a group, no member may criticize another person's idea at this stage of the process. Experience has shown that when people are free from the fear of being shown wrong or even of seeming impractical, they can produce novel ideas much more readily.

In the second, or "red light," stage the individual or group becomes judicial and considers each hypothesis carefully, retaining all those that have a remote possibility of being useful. These are then considered further and eventually a few of the most promising are tried out.

Osborn's practical method sometimes hastens the creative process by removing some of the ordinary inhibitions of thought and by making the events of the incubation period explicit and conscious (Youtz, 1955).

Frustration and stress. The effect of frustration on problem solving has been the subject of a number of studies, among them one conducted to determine the influence of frustration in one task on performance in another task immediately following.

In this experiment a group of psychology students in India were given a problem-solving test and divided into two groups equated on the basis of their

scores. Four months later they participated in the second part of the experiment. While the members of the control group were asked to write two Thematic Apperception stories, the members of the experimental group were frustrated by being given a block-tapping test so difficult that success was impossible. The experimenter then showed them false norms and expressed concern about their failure.

Later the original problem-solving test was given again. Both groups gained significantly over their original performance, but their behavior was quite different on different parts of the test. On the first problem the experimental group showed a greater gain than the controls, being highly motivated to succeed this time after having failed on the block-tapping test. Then, at the point in the test where the problems became much harder, the frustrated group fell off sharply in their performance, while the controls continued to improve steadily. Subjects who had shown the most frustration in the block-tapping test were those who did most poorly on the difficult problems (Mohsin, 1954).

Another study of the effects of stress upon rigidity employed the water-jar problems.

Subjects had previously been given a different test, being told that those with questionable records would be called for retesting. Fifty were called in and alternately assigned to "stress" and "praise" groups. The experimenter told members of the stress group that their tests showed maladjustment and that further tests would provide a more accurate diagnosis. The praise group were told that their records were unusually good and that the further tests were for correlation purposes. Both groups were then given the water-jar problems. The praised group made significantly fewer rigid responses and also solved the problems more rapidly than did the stress group. When subjects were asked finally to complete a rating scale showing their attitudes toward the experiment, the praised group, as we might expect, expressed more positive attitudes (Cowen, 1952).

Other studies have also shown that when people do not feel they must defend themselves from threat, they show much greater flexibility in exploring new solutions (Cowen, 1952). This undoubtedly is one of the reasons for the success of Osborn's method of creative thinking described above—that is, in the "green light" stage the individual can feel completely free to "brainstorm" without fear of judgment or criticism.

The influence of attitudes. We have all seen people become so emotionally involved in the defense of a controversial position that they seem blind to logical arguments on the other side. This phenomenon has also been demonstrated in a number of laboratory studies.

In one such study subjects had to solve forty syllogisms, half of which dealt with socially controversial material and half of which were neutral. Each controversial syllogism was paired with a neutral one as to form, validity, and approximate number of words, but the neutral and the emotionally loaded syllogisms were presented in different order to different subjects. The subjects were asked not only to judge the validity of each syllogism but also to state whether they agreed or disagreed with its solution.

Most subjects solved the neutral syllogisms more correctly than the emotionally toned ones. Previous knowledge of the truth or falsity of the conclusions of the neutral syllogisms influenced the subjects' reasoning in the direction of that knowledge, and their attitudes and beliefs about the emotionally toned syllogisms tended to influence their reasoning in the direction of their convictions. The subjects who solved all the controversial syllogisms first, as one group did, did the most poorly on the neutral ones, whereas the subjects who solved the neutrally toned syllogisms first did better than others on the emotionally toned ones (Lefford, 1946).

This experiment shows that emotional subject matter can affect logical reasoning not only in the immediate problem but also in those which follow it.

COMMON PITFALLS IN THINKING

Certain pitfalls are so common that we probably all are guilty of them from time to time—especially when we are working in fields where our knowledge is relatively meager. If we are aware of these pitfalls we can do much to avoid them and thus train ourselves to think as clearly and objectively as possible.

All-or-nothing thinking. One feature of cloudy thinking is that it usually is "all-or-nothing." For example, we cannot make the sweeping generalization that "criminals are cowards," because certain criminal acts require extraordinary bravery (Metfessel, 1940). No one is all good or all bad, although

our movies and radio and TV programs constantly foster this oversimplification.

Other examples of all-or-nothing thinking include the popular tendency to think in terms of stereotypes or rigid preconceptions which are applied to all members of certain national, political, occupational, or racial groups, whether they actually hold for most members of these groups or for only a few who are then said to be "typical." In most areas of human life, characteristics are found in degrees rather than in all-or-nothing amounts.

Desire to believe. As we have already seen, numerous studies by psychologists have shown that we tend to forget unpleasant facts faster than pleasant ones and that belief is affected by desire to believe, regardless of the evidence for or against a proposition. Darwin was so well aware of this fact that he made a particular effort to find and record evidence which was contrary to his theory of evolution. Do not trust your memory, especially with regard to facts or suggested solutions which are unpleasant. They are more elusive than the things that you prefer to believe. Try to be aware of your preconceptions and to remember how they may affect your reasoning in spite of your intentions to be objective.

Being misled by "big words." The good thinker is not fooled by high-sounding, two-dollar words. Big words and technical terminology often cover up a basic lack of clarity of thought. Ideas often can be expressed better by simple, short, clear words than by complicated terminology. For example, the words, "Abide until the lactating ruminant quadrupeds retrovert to their permanent domicile," tend to conceal the basic idea being expressed—wait till the cows come home.

There is nothing necessarily wrong with "big words" if they do not lull you into the belief that you really understand them when you do not or that they always express a profound thought.

Words versus meanings. If we are not careful to use words consistently, we invite confusion. For example, the word *association* means different things to different users of the term. As we have seen, most psychologists consider association merely as a relationship between a stimulus and a response whereby there is a tendency for the response

to follow an occurrence of the stimulus. Some authorities, however, use the word to indicate an actual connection in the nervous system which produces a conditioned response to a stimulus. The term may also indicate merely a correlation between two events without any implication of a functional or causal relationship between them. Thus, when the student is making a comparative evaluation of two different opinions regarding "association," he needs to know whether both authorities define the term in the same way. Carelessly assuming that things with the same name are the same thing is one of the most frequent errors in loose thinking.

Incomplete or faulty information. Before you accept and quote opinions you read in books, magazines, and newspapers or hear over the air, make an effort to determine their authoritativeness. Scientific writing, for example, must constantly be checked against the logic of science, as discussed in the preceding chapters, and the reported data must be examined carefully. In more popular writing the author may not give the full details or evidence as he would in a scientific work. In this case it is especially necessary to check the standing of the author. Make sure that he is writing in the field of his earned reputation; for example, a physician—no matter how well known he is in his own field—may or may not have sound ideas on religion, politics, or economics. When an author is writing outside his own field, test him as you would any other amateur; make him give the evidence.

Learn how to read the newspaper critically. We have all heard someone say, "It's true all right; I saw it in the newspaper." Many of us have not yet outgrown such blind acceptance of anything we read in print. The accuracy of newspaper accounts suffers from many possible sources of error. In the first place, newspaper reporters work under great pressure. They might prefer to stop to check details for accuracy, but they have to meet a deadline.

Another important influence in the editing of news is deliberate or unconscious bias. The values of the editor and publisher, for example, may well be those of their advertisers. Such persons may slant the news in the direction of the interests of the "owner group" and against, for example, organized labor. On the other hand, publications controlled by labor unions are just as apt to slant the news

in their own direction. In reading newspapers it is well to note how the same story is handled by papers of different bias. The truth about a strike in a large steel mill will probably lie somewhere between the account given by a pro-labor paper and one owned by politically conservative publishers.

Ignoring alternative hypotheses. Attempts to explain facts under a single hypothesis without considering all the possible alternative explanations are very characteristic of cloudy thinking. Sometimes, of course, alternative hypotheses are obscure, and failure to take them into account is unintentional. For example, before the time of the astronomer Copernicus, everyone accepted the hypothesis that the earth was the center of the universe around which all other heavenly bodies revolved. Because the available evidence at that time seemed to support this hypothesis, astronomers failed to consider the alternative explanation that the earth moved about the sun. Only an accumulating amount of evidence which was inconsistent with the hypothesis of the ancients led to the adoption of the Copernican theory. Thus, even when alternative hypotheses are not apparent, it is important that we keep an open mind in case new hypotheses do appear.

Often the facts one collects through research, reading, or conversation may be explained and unified in terms of *several* hypotheses, and we need to be on the alert for different possibilities. The scientist or critic examines all the facts which may have a relationship to those he is interested in and decides which of all these relationships are most likely to be worth further study. He constructs a hypothesis about these relationships and then proceeds to test it against the facts. If he fails to recognize all possible hypotheses, he reduces his chances of discovering the true relationships.

Not considering all the data. A false conclusion may be consistent with part of the data but inconsistent with another part. As long as we neglect this other part of the data, the solution is inadequate. If we let theory-making precede the collection of data, we are particularly apt to select cases which prove what we *want* to prove. Therefore, we must let the *data* suggest the theory. To reverse this process, letting a theoretical solution suggest the data, is to invite error. Suppose that you have formed a theory that red-

headed persons are hot-headed. You can always find instances of red-headed hotheads, but you must be certain that the proportion of redheads among hotheads is greater than the proportion of redheads among persons who are not hot-headed before you can draw the conclusion.

The failure to recognize all the facts about a situation is very common in all our thinking. When food prices first started to mount during the worst of the postwar inflation, newspapers and radios carried reports of the number of persons in the country suffering from vitamin deficiencies. The explanation given was that because of the high prices American families were no longer able to buy enough food of the right kind. Two facts were not taken into consideration: first, that even during normal times there are many families who are too poor to buy necessary foods; and second, that even people with sufficient incomes often lack vital information about nutritional requirements. Obviously, not all the vitamin deficiency could be explained by the high food prices.

Mistaking correlation for causation. As we saw in Chapter 3, the fact that two things go together (are *correlated*) does not prove that one causes the other. If we find a positive correlation between people's intelligence test scores and the number of times people go to see a physician, for example, we cannot interpret this to mean that bright persons are more sickly than average. The correlation probably means simply that seeing the doctor is a health precaution taken more often by the intelligent than by the unintelligent person. Similarly, a correlation between grades in Latin and in English does not necessarily mean that one is causing the other. When two conditions occur together, it may be that one is causing the other, or it may be that both are being influenced by a third factor.

CHECKING YOUR THINKING AND OPINIONS

Some thinkers go wrong because they accept the first solution that is suggested without going to the trouble of testing it. There are several ways you can try to check your own thinking.

Getting another person's judgment. One good way to protect yourself is to give your solution to some other person for criticism. If

you cannot convince an intelligent, interested, and open-minded person that your solution is right, there may well be something wrong with it that needs checking.

Using formal logic. Logic provides another means of checking yourself. Many of the principles studied in formal logic are so technical that students often think they are employed only by the highly trained thinker. Actually, we all make extensive use of syllogistic reasoning. Usually, of course, we do not state our syllogisms in full form—we state merely one of the premises from which we draw the conclusion, and often we even put the conclusion first. For example, you may hear a person say, "I don't believe the government ought to pay for the education of medical students, because that would be socialistic." This argument represents an abbreviated syllogism, with one of the premises taken for granted. Stated fully, it would run:

All socialistic measures are bad.

Government subsidizing of medical students would be socialistic.

Therefore, government subsidizing of medical students would be bad.

This example indicates how people can come to faulty conclusions by failing to state their premises fully and to define their terms carefully. For example, we might ask this person what he means by a "socialistic measure," and he might respond that he means some enterprise which the government runs but which could be handled by private management. We then might ask him if he believes that the government should return all schools, fire departments, and parcel post carrying to private hands. He will probably come to see then that he does not really accept his first, unstated premise—that is, he does not really believe that all socialistic measures (as he has defined them and as the term was used in his argument) are bad. But if he believes that some governmental enterprises are bad and some good, then obviously he is judging them on some basis other than mere government ownership, and he must discover what that basis is. Much of our cloudy thinking occurs because we accept premises which are faulty or which we have not carefully thought through.

Another question of interest to psychologists is whether there are any devices or in-

tellectual tools by which we may be more sure that we are drawing appropriate conclusions from given premises. One such device is to translate each statement into terms of letter symbols. In some cases this symbolic presentation of an argument gives appreciable help in checking the soundness of a conclusion.

One experiment on the use of the syllogism found that more than half the subjects marked the following syllogism as valid.

All Mongolians are slant-eyed.
The Chinese are slant-eyed.
Therefore, the Chinese are Mongolians.

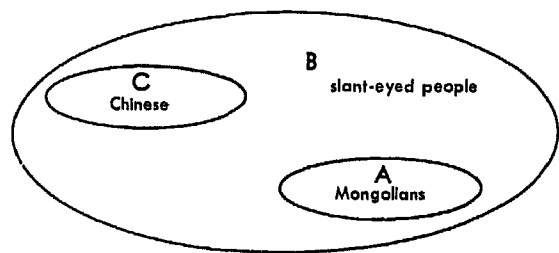
Notice that the conclusion is correct but that it does not follow from the two premises. When the syllogism was stated in terms of letter symbols which themselves carried no meaning (all A's are B; all C's are B; therefore all C's are A), the subjects made only half as many errors. However, although items representing very common fallacies are much less difficult in symbolic form, the experimenter's final conclusion was that most items actually *increase* in difficulty as the material is translated from familiar into abstract terms (Wilkins, 1928).

Avoiding the atmosphere effect. A factor which often causes us to accept invalid conclusions of the kind described above is the *atmosphere effect*. As a result of this form of "set," which occurs in problems or situations involving a closed series of responses related to a single task, the individual tends to make a response which is similar in quality to the general tone of the situation. For example, the above syllogism dealing with slant-eyed people sets up an affirmative atmosphere. "All Chinese are Mongolians" is so similar in quality to "All Mongolians are slant-eyed" and "All Chinese are slant-eyed" that it seems fitting to accept it as a valid statement. The atmosphere effect may also lead to acceptance of valid conclusions.

The presence of the atmosphere effect—and the fact that most people are unaware of its presence—was demonstrated in a study in which sixty-five adults aged twenty-one to seventy, untrained in logic, were tested on 180 abstract syllogisms, only 52 of which were valid. The abstract version of the invalid slant-eyed syllogism was stated in this study as follows: "If all X's are Y's and if all Z's are Y's,

then all X's are Z's." This conclusion was considered valid by 58 per cent of the subjects, and 63 per cent marked as valid the other conclusion which was similar in atmosphere to the premises, namely, "Some X's are Z's." (Actually, no valid conclusion can be drawn from the premises in this syllogism.) The two conclusions which did not agree with the atmosphere of the premises were marked as follows: "No X's are Z's," 14 per cent; "Some X's are not Z's," 17 per cent. None of the subjects reported having been conscious of an atmosphere effect (Sells 1936).

A good method of overcoming the atmospheric effect and checking our opinions is to use a graphic representation. Let us draw a diagram of the relationships in the Mongolian and slant-eye problem.



The area within the large ellipse represents B, or slant-eyed people; the area in one of the smaller ellipses lying within the larger one represents A, Mongolians. The relationship of the two ellipses shows that Mongolians are slant-eyed people. Area C (Chinese) must also fall within the area B, which contains all slant-eyed people, but may or may not overlap A (Mongolians). Notice that the conditions stated in the syllogism are satisfied when this is done.

Using semantics. Recently a new technique for sharpening one's ability to think accurately has sprung up under the name of *semantics*. Semantics emphasizes a point frequently lost sight of—that concepts are abstractions from real things and that the word which stands for the concept is removed by still another step from original perception. Our concepts grow from our perceptions, which, as we have seen, may or may not be an accurate mirror of "what is there." Thus, when our perceptions are distorted, our concepts are likely to be distorted too. And thinking based on these distorted concepts will probably bear faulty conclusions. Many of our prejudices are concepts of this type—

concepts that are not in accord with reality, such as that a certain group of people is "naturally stupid" or "all out to take advantage of us." The solution of our social and international problems is complicated enormously by the fact that we all start with so many misconceptions and inevitably base our thinking on them rather than on the actual facts. The responsible citizen must constantly check his conceptions and beliefs against whatever dependable, objective data he can find.

This whole problem of the relationship between our concepts and reality—whether the meanings of our words and other abstractions correspond with reality—is the problem of semantics. Often disagreements can be traced to *semantic confusion*—to the fact that people are using terms whose meanings are not precise or agreed upon. Often, too, as we have seen, the same term is used with different meanings at different times.

Frequently, in the course of a heated discussion, someone will say, "It all boils down to a question of semantics." What he means is that if the disputants could agree on the precise meaning of the terms they were using, much of their disagreement could be settled. Laymen as well as scholars are coming to realize more and more the importance of semantics in accurate thinking and accurate communication.

A useful principle of semantics is that definitions should be *operational*; that is, they should not merely classify an object but should tell *what to do* in order to experience the thing defined (Rapoport, 1952). An example of an operational definition would be a recipe, which is an operational definition of a particular dish.

Semantics also emphasizes the need for testing every statement. Even a simple one like "Grass is green" needs to be clarified, for while grass may be green in Missouri in August, it is brown in Southern California during that month. Therefore, we must know what grass is under discussion. Also, the nature of the greenness must be considered, for the green of grass is quite different from that of an olive or a piece of jade. Deciding whether such a statement is true involves relating it to some kind of experience. If you look, you will see whether grass is green and under what conditions it is green. The criterion of truth for a statement is its predictive value.

Considerable study has been devoted to the part that semantic confusion can play in the development of abnormal behavior. This approach to mental hygiene stresses the point already made that words are merely symbols which may or may not designate real objects and events. In using language, therefore, the individual must be careful not to confuse words with reality (Korzybski, 1948). The severely neurotic or psychotic person who retreats from reality loses his power to distinguish between words and concepts and the reality from which they were derived. Thus he no longer checks his beliefs against reality and soon runs into semantic trouble. For example, one would question the mental health of a person who, in all seriousness, described his plans to organize an expedition into Greece to hunt unicorns. The fact that he can give a verbal description of a unicorn and perhaps even produce a drawing of one does not alter the fact that the unicorn is a completely mythical animal. Belief in the existence of unicorns—that is, the tendency to regard a word symbol as a real object—is a form of delusion. From the viewpoint of general semantics, men may become progressively more or less adequately adjusted as their verbal techniques mirror or distort the structure of the universe.

CYBERNETICS

We hear a great deal today about ultra-rapid computers or "electronic brains" which are capable of solving complex mathematical problems in a matter of seconds. There is no theoretical limit to the possible level of development of such machines, which not only can solve problems but also can "think," predict, and store memories. The world of the science fiction writer, in which automatic factories are controlled completely by artificial brains, is no longer sheer fantasy.

To scientists engaged in the development of high-speed electronic computers, certain similarities between these artificial brains and the human nervous system have become increasingly apparent. It has been suggested that the methods of study and analysis involved in computer engineering and experimental neurology are often identical and that

each field has much to offer and gain from the other. Slowly these two fields have begun to merge into a single science, which has been named *cybernetics* by Norbert Wiener, one of its principal spokesmen (Wiener, 1949). Derived from the Greek word meaning "steersman" (which is also the source of the word "governor"), cybernetics is defined as the *science of control and communication in the animal and machine*.

SERVOMECHANISMS

One of the principal contributions which cybernetics has thus far made to psychological understanding lies in its application of the principles of servomechanisms to human behavior. To understand the concept of a servomechanism we must consider three types of machines. First, there are machines which are random and nonpurposeful, such as a roulette wheel or nonprofit slot machine. Then there are machines which are orderly but nonpurposeful, such as a watch or an ordinary gasoline engine. Such machines are, of course, built for a purpose, but they do not themselves have a built-in purpose; that is, they have no final "goal" or position to achieve but merely continue to operate in an orderly fashion until they either run down or run out of fuel.

There are some machines of a third type, however, which are intrinsically purposeful or goal-seeking. Such machines are called *servomechanisms* (Rosenblueth, Wiener, and Bigelow, 1943). An example of a servomechanism is a torpedo with a built-in target-seeking device which enables it continually to change its course in pursuit of a moving target until contact is made. Intercontinental ballistic missiles also depend on servomechanisms for their effectiveness. Servomechanisms differ from other machines in that they are sensitive to certain stimuli and respond to them. The target-seeking torpedo, for example, is sensitive to stimuli coming from the target and responds to those stimuli until it reaches its goal, much as a pilot flying a plane by instruments comes in "on the beam." Such stimuli act as a source of information to the mechanism, reporting back to it how far it is deviating from its goal. The mechanism is therefore "error sensitive" and is able to respond to stimuli in such a way that its deviation from the right course is continuously

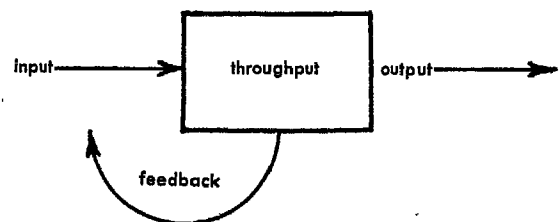
corrected. This type of error-correcting information is called *feedback*.

A servomechanism is considered to involve four basic components: input, throughput, output, and feedback. The relationships between these four operations are shown below.

Cybernetics has made an analogy between the operations of servomechanisms and the behavior of human organisms. *Input* refers to the stimuli which initiate the activity of the machine or organism. These may be external stimuli such as the light waves reflected from a pencil which the organism wants to pick up, or internal stimuli such as hunger pangs which direct the organism to the refrigerator. These stimuli acting on the organism create activity within the nervous system. This nervous activity is called *throughput*. The nervous impulses (throughput) activate muscles which produce a response. Each finite response is an *output*, and the sum total of output in a situation is the behavior pattern, which is culminated when the goal is attained.

Output is continually corrected by *feedback* information. This will be in the form of external stimuli (such as light waves coming from the goal) and internal stimuli (such as kinesthetic cues coming from the muscles). If the organism is deviating from its goal at a given instant, the feedback will indicate what change or correction in the response is needed during the next instant. But if the organism is exactly "on the beam," the feedback will have no effect on the behavior. For this reason, the function of feedback in a response at any given instant is considered to be determined by the nature of the response during the preceding instant.

To illustrate how a human behavior pattern may be described in terms of these operations, suppose that you wish to pick up a book which you see lying on the table. In this situation the input includes such stimuli as the light waves coming from the book and your motivation to pick up the book. These stimuli



cause a complicated train of activity along the paths in the nervous system leading to the muscles which activate the arm. This nervous activity is the throughput. A series of muscular contractions in the arm then begins, and the muscular contractions occurring at any instant are output. As the hand begins to travel toward the book, the muscular activity involved in the response creates kinesthetic stimuli which, along with visual stimuli, act as feedback. This feedback function reports back to the brain the amount by which the hand is missing the book and thus acts as a new kind of input. The brain responds to the feedback by directing the muscles to correct for any deviation which the hand may be making on its way to picking up the book. In the preceding chapter, we saw how knowledge of results during learning also acts as feedback to improve later performance.

Even though the entire pattern of responses involved in an act like picking up a book may take only a fraction of a second, kinesthetic feedback is operating continuously on an unconscious level. Much of the feedback which directs routine activities is unconscious, although conscious feedback is also important, particularly in activities which require concentration and mental effort. The importance of kinesthetic feedback is clearly seen in individuals suffering from *tabes dorsalis*, or syphilis of the central nervous system. In this disease certain spinal nerves which normally convey kinesthetic stimuli from the muscles to the brain have been destroyed. Individuals with *tabes dorsalis* have great difficulty in making successful leg movements, even though there is nothing wrong with their muscles, because they must depend almost entirely on visual feedback.

NERVE NETS

One of the most fascinating areas of cybernetic study is its postulation of *nerve nets*—intricate, interconnecting communication channels along which nervous impulses travel during throughput (Culbertson, 1950). Although modern neuroanatomy has not yet reached the point of technical development which will allow us to trace in detail these ultramicroscopic pathways in the human or animal brain, it is possible to describe hypothetical nerve nets to account for all types of behavior. Many hypothetical nerve nets have already been postulated to account for the

nervous mechanisms involved in learning, permanent memory, short-term memory, and form perception.

Some nerve nets which the cyberneticist studies are "human" in the sense that they explain forms of behavior which the human organism is capable of performing, while other nerve nets are "superhuman" in that they will produce behavior of which the human being is not capable. The elaborate electrical pathways and connections involved in giant computing machines are such "superhuman" nets. Their only superiority over man is their speed and accuracy (Fry, 1956). Their great inferiority as compared to man is their complete lack of creativity. Created through the application of man's great powers of imagination, the biggest, best, and most expensive computer is a mere robot.

If the human nervous system is really as similar to electronic servomechanisms as cybernetic studies seem to indicate, a wide and profitable field of psychological research is open to investigation. By describing hypothetical nerve nets to explain various aspects of human behavior, it may be possible to build machines based on those specifications which will exhibit the same or similar behavior. For instance, it has been considered highly likely that the nerve nets involved in human visual imagery may be quite similar to the electronic connections which produce an image on the screen of a television set.

Although neural activity underlies all human behavior, relatively little is understood of the detailed functioning of the central nervous system. Lacking such information, psychologists have found it difficult to relate their theories of behavior to the underlying physiology, although in recent years strides have been taken in this direction (Rashevsky, 1948; Hebb, 1949). As the psychologist's present position has been expressed:

"An engineer who is called upon to repair a machine of which he knows the inputs and outputs but not all the internal mechanisms calls his problem a 'black box' problem. From his limited knowledge he will nevertheless often be able to trace the defective part and repair his machine. The human brain is to a large extent such a 'black box'" (Barrett and Post, 1950).

For further discussions of attempts to find out what goes on in this "black box," see pages 544-547 and 558-562.

SUMMARY

Thinking—the process of dealing with *symbols* or signs standing for absent objects or ideas—may involve images, language, tiny muscular contractions, concepts, or all of these.

Although *images*, or mental pictures, do not seem to be essential to thought, they commonly play a part in thinking. Some individuals possess *eidetic imagery*—visual memory almost as strong and clear as actual perception—and perhaps one person in ten experiences a form of *synesthesia* in which sounds are translated into visual images.

Thinking can be performed without the use of words, but normally *language* plays an important role in thought. This is true even for the small child who lacks the vocabulary to express accurately the ideas he has reasoned out. He may not know the correct verbal label for the *concepts* he has abstracted. *Conceptualization*—the grouping of objects in terms of some distinguishing common property—begins at the physical level and becomes increasingly abstract with intellectual maturity. Abstract concepts include both the precise terms of science and the less precise, ever changing terms we use in making value judgments.

According to the Whorf theory, language patterns have great cultural influence, restricting the development of concepts and affecting thought generally. Although by no means universally accepted, this hypothesis has stimulated increasing interest in the relationship of language patterns and thought.

The minute muscular contractions which accompany thinking are called *implicit* speech or gesture. Sensitive recording apparatus reveals that people do “talk to themselves” while reading silently, but it is not known whether the movements are a cause or an effect of thinking. There is no doubt, however, that thinking of an act is correlated with impulses in the appropriate muscles.

Our thinking is to some extent personalized, since it takes place within a *context* made up of our background of experience, our motives and attitudes, and our particular mental “set,” which may either help or hinder problem solving. The thinking we do ranges from *realistic* (and productive) to *autistic*. Autistic thinking, which includes dreams and fantasies, frequently involves an escape from the real world and has no practical objective.

Realistic thinking takes place when we use facts and concepts to solve specific problems.

Problems may be solved by explicit trial and error (action) or implicit trial and error (thought) or both. Whether or not thinking is used depends in part upon the type of problem. The following steps are involved both in problem solving and in artistic creation: (1) becoming concerned about or interested in the problem, (2) assembling the materials with which to work, (3) deriving a number of possible solutions, (4) evaluating the suggested solutions, and (5) objectively testing and revising the solutions.

Cloudy thinking is a major impediment to problem solving. In general, the greater an individual's relevant experience in a given field, the more concepts and generalizations he will have as tools for solving new problems in that field; but *mechanization* and *functional fixedness*—a rigid continuation of behavior or perception—may hinder problem solving. Frustration and stress and emotional attitudes also interfere with logical reasoning.

Among the common pitfalls in thinking are the all-or-nothing approach, the desire to believe the pleasant and forget the unpleasant, the tendency to be impressed by “big words,” the assumption that a term always means the same thing, the acceptance of information based on ignorance or bias, and the failure to consider possible alternatives. Then, too, we often base conclusions on incomplete data and mistake correlation for cause.

There are several ways of avoiding these pitfalls: having an intelligent critic check our solution, making use of the syllogism, diagramming our conclusion to overcome the *atmosphere effect*, and checking the relationship between our concepts and reality according to the techniques of *semantics*.

Cybernetics, the science of control and communication in the human and the machine, merges the fields of computer engineering and experimental neurology. Named by Norbert Wiener, cybernetics applies the principles of *servomechanisms*—machines intrinsically purposeful or goal-seeking—to human behavior, describing human behavior patterns in terms of the basic components involved in a servomechanism—input, throughput, output, and feedback. The cyberneticists' postulation of *nerve nets*, ultramicroscopic pathways along which nerve impulses travel, suggests the possibility of a new and exciting approach to problems of human behavior.

PART FOUR

PSYCHOLOGY

So far we have been talking largely about the individual person—how he develops and changes, how his abilities and other traits are measured, what propels him to action, how he may react to frustration and stress, and how he perceives, learns, and thinks. These processes are the classic subject matter of psychology and, as a result, are the processes which have been studied most thoroughly by psychologists. In the last two decades, however, there has been increasing realization that not all man's behavior can be understood or explained by examining the individual in isolation or by looking for forces and processes inside him. Much of his behavior seems to be induced by forces outside him, such as the groups of which he is a member, and to change greatly in different physical or social settings.

And so, in this group of chapters, we shall study some of the effects of different settings. First, we shall devote two chapters to seeing what psychologists have discovered about group processes. Here the research has been going on only a relatively short time; there are many gaps in our knowledge, and studies often give contradictory results. As methods of research are further refined and controls better worked out, these inconsistencies will undoubtedly be explained, and the findings will be better integrated than they are today. In our study of group processes we shall also examine some of the problems that arise in our group living—problems of leadership and group efficiency, marital problems, prejudice, crimes and delinquency, and how children can best be educated for citizenship in a democracy.

Almost every moment of our waking day we are bombarded with ideas that someone else would like us to accept and act upon—via television, radio, billboards, newspapers, magazines, books, and so on. Mass communication in our day is not only big business; it has become both an art and a science. We need to know how it operates, how effective it is, and just what its effects are. So in Chapter 16 there is a summary of psychological findings in this field, with a description both of the methods used in the mass media and the methods used by psychologists to study the effects of mass media on people's attitudes and behavior. No area of psychological knowledge has a greater potentiality for good—or evil—than the knowledge of how to change people's attitudes.

One of the most fruitful fields in which psychologists have labored in recent years has been in applying the techniques of psychology to the problems of industry. This has included working out selection of employees and training methods, discovering the physical and psychological factors that make workers happy and efficient, and designing equipment and work space for maximum efficiency and safety. The final chapter in this group, then, will review the present accomplishments of psychologists on the industrial scene and their potential role.

CHAPTER FOURTEEN

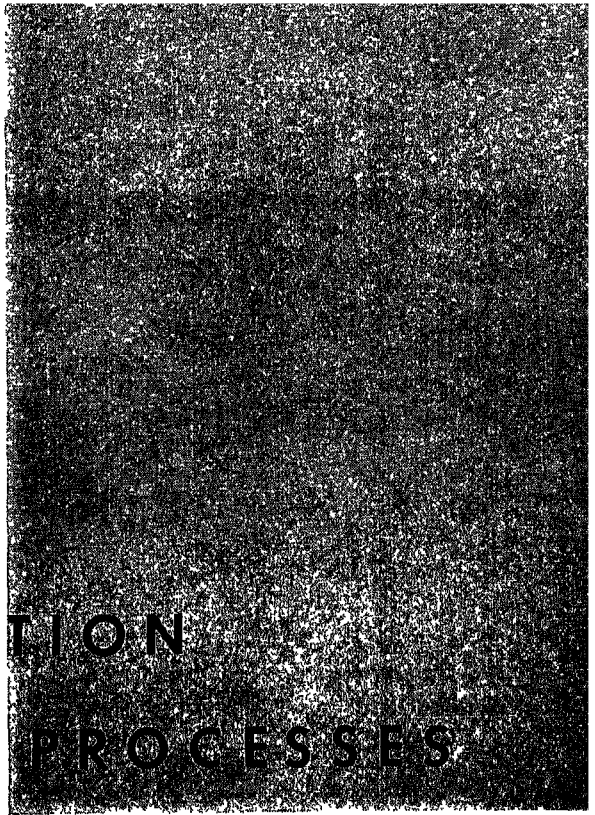
COMMUNICATION AND GROUP PROCESSES

INFORMATION THEORY

GROUP DYNAMICS

EFFECTIVE LEADERSHIP

COMPETITION AND COOPERATION



Perhaps man's greatest asset is his ability to communicate the products of his learning to other people. Communication enables many persons to benefit from the experience of one. Thus man does not have to "start from scratch" each generation but is able to start where his ancestors left off—to avoid the errors of the past.

Man's ability to communicate his knowledge and feelings is so taken for granted that we seldom stop to think what life would be like if we were cut off from easy communication with our fellow men. Helen Keller, deprived of both sight and hearing in early infancy, has described the terrible isolation she experienced as a child: "Meanwhile the desire to express myself grew. The few signs I made became less and less adequate, and my failures to make myself understood were invariably followed by outbursts of passion. I felt as if invisible hands were holding me, and I made frantic efforts to free myself" (Keller, 1903).

Communication is an indispensable process underlying the organization and functioning of any group, whether it be as small as a two-man team or as large as a great nation; for in order for people to strive toward the same goal at all, they must operate on the basis of common information. Communication among the members of a society not only enables them to mobilize for social action but also is an essential factor in creating the pattern of common attitudes, opinions, and customs that underlies their whole social structure.

INFORMATION THEORY

Today we stand on the threshold of a new era in the understanding of communication. Interest in *information theory* is growing rapidly. Information theory may be defined as the principles that make for understanding, control, and predictability in communication.

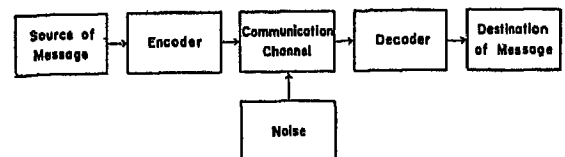
There are many "systems" of communication. When information passes between two people, an object and a person (a recording machine to a stenographer, for example), or an object and an object (the keyboard and paper in a typewriter), communication has taken place. The passing of information can be immediate (as when a boss dictates to a recording machine) or delayed (as when the stenographer transcribes the dictation at a later time).

PARTS OF A COMMUNICATION SYSTEM

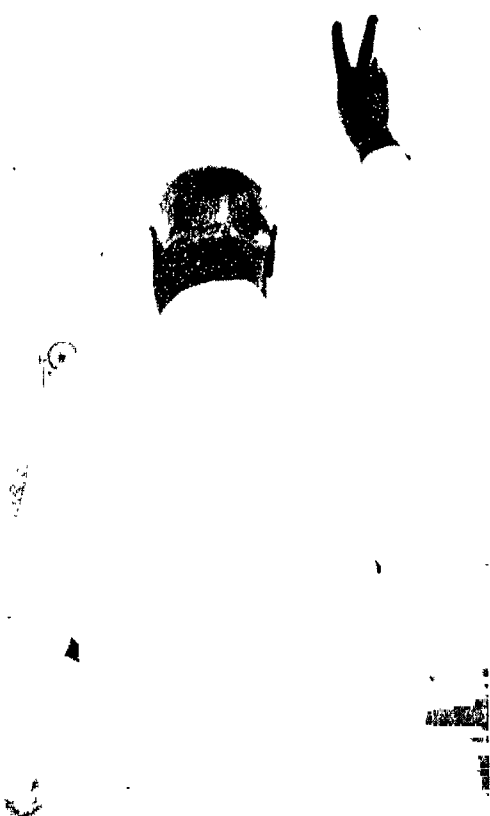
The essential steps involved in the passing of information comprise a communication system. We use many kinds of communication systems every day. For example, when we pass

information to a friend by word of mouth, we employ a vocal communication system; when we send a letter, we use a written communication system. Often there are a number of subsystems through which the information must pass before it reaches its final destination. When information is transmitted through a human being, the ultimate communication system is the nervous system.

All communication systems can be analyzed in terms of five basic parts: (1) *source*, (2) *transmitter*, (3) *channel*, (4) *receiver*, (5) *destination* (Shannon, 1948). The fundamental nature of all communication systems is represented symbolically below.



Communication involves the transfer of information, in the form of energy, between two separate points—a *source* and a *destination*.



Even in our highly verbal society we often communicate with each other by gestures. Some gestures, like Churchill's famous V-for-victory sign, are very simple and obvious; others, like those used by Herbert von Karajan in conducting the Berlin orchestra, may be highly elaborate and extremely subtle. Probably the most complex system of signs is that used by deaf mutes, who have a whole language of gestures.

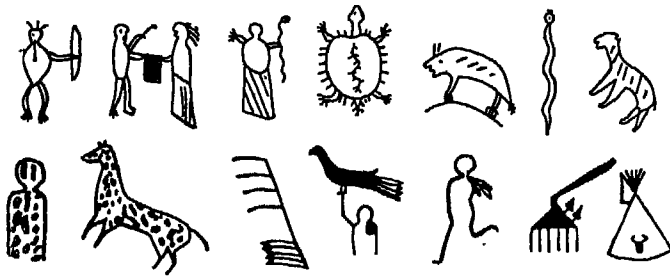
tion—within an interval of time. The link which connects source and destination and supports the passage of information energy between them is the communication *channel*; it may be a telephone wire, a piece of paper, or simply air. The operation of converting information into transmittable energy—for example, converting ideas into speech sounds—is called *encoding*, and the message as it passes over the channel is called the *coded signal*. Encoding is performed by the *transmitter*, which in the case of spoken commu-



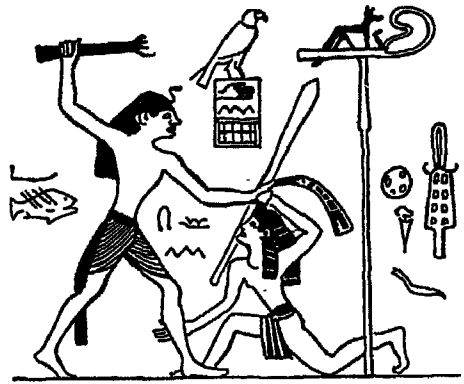
nication would be the human voice mechanism. When the coded signal has passed over the channel, it is decoded by the *receiver* so as to be usable at its destination. For speech, the ear is the receiving mechanism.

THE IMPORTANCE OF FEEDBACK

All too often it is assumed—in the classroom, office, and shop, as well as in the lecture hall or the radio station—that one person can effectively transmit information to another



Written languages probably started with pictographs like those used by Egyptians (right) and American Indians (above).



without being aware of the latter's reaction. Actually, however, communication must be a two-way street. If A is to be efficient in transmitting information to B, he must know something about B's progress in learning. There must be feedback from B to A.

A recent study was designed to test the effects of four levels of feedback: (1) zero feedback, in which instructors were completely separated from students; (2) the visible audience situation, in which students could not speak to but were visible to the instructor; (3) a yes-no condition, in which students could reply only "yes" or "no" to questions from the instructors; and (4) free feedback, in which students could ask questions or interrupt whenever they wished.

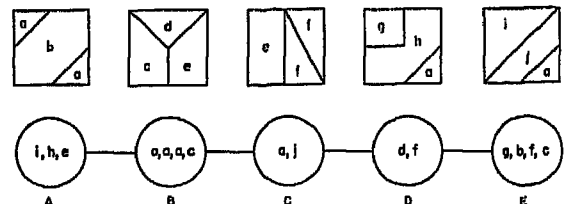
The instructors described abstract geometric patterns to the students, who were to reproduce the patterns. Accuracy of the reproductions steadily increased from zero feedback to free feedback conditions. However, the time required to give instructions also increased. Therefore, a further experiment was conducted, using only zero and free feedback situations, over a longer series of trials. Under free feedback the accuracy level was high on the first trial and stayed high. Under zero feedback, accuracy improved a great deal on successive trials, but it never reached the level which was achieved on the very first trial under free feedback. The amount of time required for instruction under zero feedback remained about the same, whereas under free feedback it decreased with successive trials. Free feedback, however, continued to require more time than zero feedback. Another interesting outcome was that free feedback generated confidence in the subjects, whereas conditions of zero feedback tended to generate hostility (Leavitt and Mueller, 1951).

In cooperative activity feedback is an especially important aspect of effective communication. The ability of an individual to

integrate his work successfully with that of the group depends on his obtaining information about the activities and progress of the other members. The extent to which communication is free or restricted has a definite influence on the effectiveness with which a group can organize and carry out a program of cooperative effort.

The importance of "social feedback" as a means of correcting errors in a group situation is shown in the following experiment.

Five paper squares were cut up into pieces that were distributed randomly to the five members of a group. The task of the group was to pass pieces or messages over the communication channels until the pieces had been so distributed that all five members could form squares. There was only one way in which the pieces could be distributed if this group goal was to be achieved. There were several possibilities, however, by which one member could form a square out of pieces needed by other members and, in doing so, completely block the progress of the rest of the group. This error would not be obvious to him unless he had knowledge of the status of the rest of the group. "Social feedback," therefore, was absolutely necessary to the success of the group problem solving; extreme restriction of the com-



The diagram on top shows how the five squares of paper in Bavelas' experiment were divided into pieces. One possible distribution of these pieces of paper to the five group members is shown at bottom.



A vital problem today is how to achieve understanding among peoples of different language groups. In the United Nations interpreters serve as an essential link in the chain of communication. However, direct communication is preferable. Hence, prospective diplomats at Georgetown University's School of Foreign Service in Washington, D.C., try to become proficient in a number of languages. Sitting in individual booths, they study their lessons by listening to tape recordings. By turning the switch in front of him, a student can hear any one of a dozen foreign-language tapes.

munication channels would have made the solution almost impossible (Bavelas, 1950).

To facilitate experimentation when actual group situations are difficult to arrange, it has been found possible to obtain similar results by using a tape recorder to simulate a group situation (Blake and Brehm, 1954). The subject wears headphones and is alone in a room;

he believes the other subjects he hears on the tape are in adjoining rooms. This automatically standardizes the major part of the experimental procedure, besides cutting down on time and expense. Group interaction, however, is impossible with this technique.

Where communication is restricted—whether in a small experimental group or in schools, industry, and political and social groups—individuals are automatically limited in the extent and accuracy of their understanding. Their distorted perception of the situation is largely responsible, in turn, for the inadequacies of their behavior.

Later in this chapter we shall consider some of the specific ways in which communication patterns can affect group activity.

GROUP DYNAMICS

People live and work in groups of many kinds—in politics, business, education, and family life. The analysis of group relations is one of modern psychology's most important tasks, and research into this vast new area has already produced some valuable findings. (See pages 547-551 for a further discussion.)

INDIVIDUAL VERSUS GROUP PRODUCTIVITY

Although it is sometimes true that "too many cooks spoil the broth," there is no doubt that many human goals can be achieved more efficiently by cooperative effort than by individual endeavor. This fact, which most people will readily accept on the basis of their personal experience, is supported by many lines of experimental evidence.

In one early study subjects were given a word and required to make up as many other words as they could out of the letters it contained. Subjects working alone were able to make up about thirty-two words within the time limit, whereas subjects working cooperatively in groups of five or six could make up about seventy-five words in the same time. The number of words per person working in groups was less than the number of words produced by an individual working alone, but the total output of a group was larger than that of any single individual working alone (Watson, 1928).

One obvious factor contributing to the greater output of groups in such situations is the fact that various members of the group can work at different parts of the task at the same time, whereas an individual working by himself can handle only a relatively small part at a particular moment. Moreover, fewer errors tend to creep into the final product of a group effort, since the errors of one individual are more readily detected and corrected by someone else (Shaw, 1932).

We saw in a previous chapter (page 345) that group recall of a story was superior to individual recall. In problem solving, too, group performance may yield better results than individual effort. For example, in one study of group problem solving the game of "Twenty Questions" was used.

In this game the participants are asked to guess the identity of some person or object. They are told only whether it is animal, vegetable, or mineral and are allowed to ask twenty questions, each of which can be answered "Yes" or "No." Because one starts with a somewhat vague problem, obtains information, uses it to formulate new questions, and so on until the problem is solved, this type of problem is similar to many of those in everyday life. In this particular study some individuals worked alone at solving the problems, some worked in groups of two, and others worked in groups of four. Since pre-testing had shown that allowing only the traditional twenty questions resulted in a high proportion of failures, groups were permitted to ask thirty questions before being charged with a failure.

Group performances were superior to individual performance with regard to number of questions, number of failures, and elapsed time per problem. Groups of four were superior to groups of two only in terms of the number of times they failed to reach a solution. In terms of man-minutes required for solution, the performance of individuals was superior to that of groups, and the groups of two were superior to the groups of four (Taylor and Faust, 1952).

There is recent experimental evidence to indicate that groups go through essentially the same steps or phases that individuals do in solving a problem (Bales and Strodtbeck, 1951). This conclusion was based on the observation of twenty-two different group tasks, such as a five-man group of novices at chess planning the first move of a seven-move problem, and a five-man committee planning the arrangements for a Christmas party. This find-

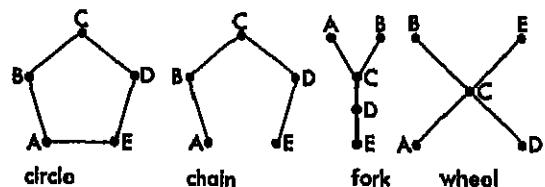
ing is not unexpected when we remember that an individual, to solve a problem, must often bring many lines of factual evidence to bear on it and must regard it from several angles. In the group situation the needed variety in elements is more likely to be presented than when an individual is working alone. This probably helps account for the fact that where there is ample intercommunication and pooling of ideas, group solutions are usually better than individual ones.

COMMUNICATION

IN GROUP PROBLEM SOLVING

We have already noted the importance of "social feedback" in reducing errors in group problem-solving situations. Research has also shown that specific communication patterns have a definite effect on both group efficiency and individual morale.

In one study the subjects were divided into four groups of five people each. The subjects in each group were seated around a table, separated from each other by partitions containing slots through which they could pass messages to each other. From a set of six symbols, each subject was given five. The symbols were distributed in such a way that only one of the six symbols was held in common by all five members of the group. The task was for the entire group to discover as rapidly as possible, by passing notes through the slots in the partitions, which symbol they all held in common. In each of the four groups, however, the messages could be passed only in certain specified directions. The four types of restricted communication nets studied in the experiment are shown in the figures below.



In the "circle" each person could pass notes to the people at both his right and left but to no one else. The "chain" was like the "circle," except that a complete circuit was not possible. The "fork" was even more restricted, four members formed a "chain" and the fifth member was able to communicate only with one of the inner members of the chain. The "wheel" was the most restricted of all the communication nets; all messages had to pass through a

central member, who was the only one to have direct communication with all the others.

During the experimental session each group completed fifteen problem-solving tasks. This enabled them to develop a plan of operation during the early trials which would make their cooperative activity more efficient in the later trials. The most rapid group to organize a stable plan of operation were the members of the "wheel"; by the fourth or fifth trial they had evolved a system whereby the four outer members sent their information to the central member, who determined the answer and sent it out to the others. The "fork" group adopted this same plan of sending all the information to the central member, who figured the solution and sent it out to the other members. Being less restricted, however, the members of the "fork" arrived at this organization more slowly than those of the "wheel." In the "chain," too, the responsibility of actually solving the problem usually fell upon one member of the group—but, because the organization was somewhat more flexible, different members assumed the role of leader on different trials. The members of the "circle" developed no consistent plan of operation but merely sent messages back and forth until each person was able to work out the answer for himself. In spite of the greater organization developed by the more highly restricted groups, the members of the "circle" were able to complete their tasks about as rapidly as the other groups, although they passed a great many more messages.

After the experiment the subjects were questioned as to how well they enjoyed their jobs. The responses revealed that, on the average, group morale was lowest in the highly organized "wheel," where there was no communication among the members except through a clearly recognized leader. The most contented group, on the other hand, was the "circle," which was leaderless but allowed the highest degree of group intercommunication (Leavitt, 1951).

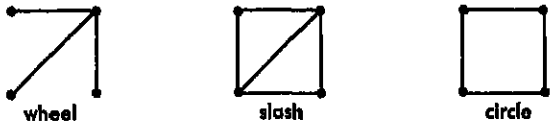
The results of this experiment are in line with other evidence indicating that feelings of group membership (or "belonging") and individual status are among the most important factors contributing to the morale of the members of a group. When the channels of communication are restricted, on the other hand, the individual members of a group tend to feel isolated or rejected. There is little to create a feeling of belonging, and group morale deteriorates.

In another experiment designed to study the effects of varying degrees of complexity in problems solved by wheel or circle com-

munication nets, it was found that in solving complex problems the circle was faster than the wheel, with the greatest difference in time showing up on the first trial. With simple problems the wheel was faster, though not significantly so. Group morale in both wheel and circle groups was higher on simple problems, and those individuals whose positions in the wheel gave them the greatest degree of independence had the highest morale (Shaw, 1954a).

The question of morale, so important to effective group performance, was studied further in another experiment on communication nets.

The communication nets used in this study were the wheel, the slash, and the circle, shown below



The three groups were given rather complex problems to solve. As you can see from the diagrams, certain individuals occupied positions of greater centrality in the group than did others. Also, the experimenter gave some subjects a greater amount of information than others. It was found that increasing or decreasing the amount of initial information given to an individual in a certain position had the effect of increasing or decreasing the centrality of that position. Centrality—or, in this case, centrality plus information—in turn determined individual morale, the number of items transmitted by an individual, and the probability that he would be chosen leader of the group. Those in more central positions could communicate more and hence enjoyed their jobs more, as revealed by a morale questionnaire which the subjects filled out after completing the task (Shaw, 1954b).

Thus far we have discussed communication in groups of individuals who all had equal status, except that the accident of a more central position in the particular net might cause one member of the group to take a leading role. In real life, however, many communication situations involve persons of differing status—teacher and students, "boss" and subordinates, and so on.

An interesting study has attempted to discover what effects a feeling of high or low status may have on communication.

Four experimental groups of eight persons each were used. The procedure followed with each group was as follows: The members were divided into subgroups of four each and told that the subgroups would work in separate rooms at solving a joint task. One subgroup would be given a diagram showing a pattern of rectangles; on the basis of messages received from the first subgroup, the second subgroup was to reproduce the pattern by placing bricks on the floor. Messages might be written about anything the participants wished, as long as sender and addressee were clearly designated. All messages had to pass through the hands of the experimenter, stationed between the two rooms, so that he could record the time of their being sent.

Actually, after being taken to their rooms, both subgroups were told that their part of the job was to arrange the bricks; and the messages delivered to the subjects came from a prearranged series of notes made up by the experimenter. Each subject received eight messages about the position of the blocks and six others irrelevant to the task—expressing the desire to get better acquainted, criticism of the addressee, wonder about the real purpose of the experiment, etc. The participants were thereby encouraged to write similar irrelevant messages, but all their messages were kept by the experimenter.

The experimenter created an atmosphere of high status in some subgroups by telling them they had been assigned the really important part of the task—making sure the bricks were properly placed. Other subgroups were made to feel low status by being told that the really important job (supposedly being done by others) was translating the master diagram into words. Half the high and low status groups were also told that, because the experimenter had not yet decided what division of labor would produce greatest efficiency, they might later have to move to the other room—which, in their view, would be either “higher” or “lower,” depending on the artificial status they had already been made to feel. Thus each experimental group felt (1) high status, with no threat to position; (2) high status, with a possibility of demotion; (3) low status, with no hope for improvement; or (4) low status, with a possibility of promotion. A control group performed the same task with no mention of status.

When asked at the end of the experiment whether they would prefer the “other” job in a (fictitious) second experiment, many more Lows than Highs wanted to make a change. In their messages the Highs made more, though not significantly more, favorable comments about the job than did the Lows; but the Lows made significantly more unfavorable comments. The Lows also sent many more irrelevant

messages, possibly to provide some escape from the task. It is likely too—since the Lows with no possibility of improving their status sent the most irrelevant messages—that these communications provided a substitute for desired change to higher status.

Besides criticizing their job more, the Lows sent more negative comments to the Highs. The Highs sent nearly all their messages of dissatisfaction to members of their own status group, apparently not wanting to depreciate their position in the eyes of the Lows. The Lows expressed most confusion about their task and the Highs the least, with the Controls falling between. It appeared that the Highs—especially those fearing demotion—hesitated to let their confusion be known.

The Controls sent more messages of personal criticism than did the other groups, indicating that the mere introduction of a status difference produced restraints on interlevel criticism. The Lows sent other Lows many criticisms of the High subgroup, whereas the Highs sent all their criticisms directly to members of the other level. There were indications that the High-mobile and the Low-nonmobile groups tended to reject persons at the other level and thus were the groups most destructive of interlevel cohesiveness (Kelley, 1951).

Although the Highs in the above experiment had no real power over the Lows, communication in real life often involves high status groups which *do* exert power over those of lower status. The results of this experiment, together with some of those cited earlier in the chapter, suggest that status affects not only the kind and quality of communication in a group situation but also the effectiveness of group activity. We shall find further evidence of this in our discussion of group dynamics and leadership.

PRINCIPLES OF GROUP DYNAMICS

Although in theory a democratic group has both the right and the capacity to make its own decisions and choose its own goals, in practice the leader often takes over these functions. To offset this tendency, many people have emphasized the importance of *group dynamics* in making cooperative activities not only more democratic but also more effective. The group dynamicists are doing much to show how a group can best operate so that each member will make a maximum contribution. They realize that group behavior is the

result of dynamic interaction between *individuals* in a social situation (Bonner, 1953).

It is important to remember that "group members are made, not born." People must learn how to work together—to see their own efforts in relation to those of the group as a whole and to apply certain proved principles for making group activity most effective. We shall consider here eight general principles for improving the effectiveness of cooperative activity—*atmosphere, threat reduction, distributive leadership, goal formulation, flexibility, consensus, process awareness, and continual evaluation* (Gibb, Platts, and Miller, 1951).

Atmosphere. One of the most effective ways to improve group activity is to improve the physical setting in which the group meets and works. The important thing here is to provide a physical situation that makes members of the group feel equal. Special seats of honor should be abolished even in the classroom, for if the principles of group work are applied, every member is a teacher and every member is a learner. Effort should be made to create an *informal workshop atmosphere*. Since desks arranged in neat rows facing the front are not conducive to group action, work tables arranged so group members can see each other are more desirable.

Whenever possible, the size of the group should be kept small, for size itself is a threat which causes people to "withdraw" from the discussion. Experience has shown that it is very difficult to get good work done in groups

of more than twelve to fifteen. One expert has commented: "The size of the group should be the smallest group in which it is possible to have represented at a functioning level all of the socialization and achievement skills required for the particular learning activity at hand" (Thelen, 1949).

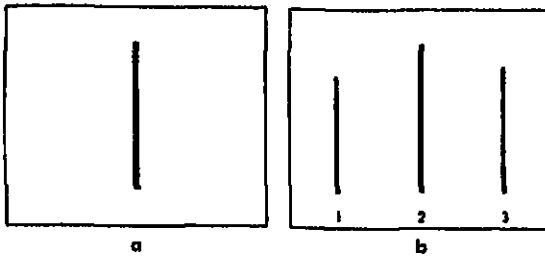
Threat reduction. There are many reasons why people feel hostile or uncomfortable in a group. Feelings of insecurity are frequently brought out by the mere presence of strangers. Often, too, present situations and persons may remind us of uncomfortable experiences in the past.

There are various ways of reducing threat, depending upon the size of the group. In groups of fewer than fifty members it is a good idea to give out name tags. The first name should be in letters large enough so that it can be read easily. In smaller groups people can tell about themselves in considerable detail at the first meeting. When time does not permit this sort of introduction, each member can be asked to limit himself to three sentences—preferably humorous—that tell important things about him.

Distributive leadership. Experience has shown that groups can function effectively without formal leaders—that the various functions of leadership can be shared by the different members of the group. Such a sharing of leadership causes each person to feel more confidence in both himself and others. The leader in the democratic group situation is not under the tension of the autocratic leader.



The principles of group dynamics apply to classroom situations. These classroom scenes in St. Louis, Missouri, show the differences in interest and participation produced in part by changes in seating arrangements and a shift from teacher to student leadership.



In an experiment conducted by Asch investigating the effects of group pressure on individuals, groups of seven to nine male college students were assembled for a "psychological experiment" in visual judgment. They were shown cards like the ones illustrated at left and asked to choose the line on card b which was the same length as the line on card a. On the first two trials, all subjects agreed. On the third, one member disagreed with the others. What he did not know was that the others had been instructed previously to give incorrect answers unanimously in twelve of the eighteen trials. The dissenter is shown at right, leaning forward to check his judgment.

In ordinary circumstances, mistakes would be made in judgment less than one per cent of the time, but under group pressure, the minority subjects accepted the majority's wrong selections in 36.8 per cent of the trials. Individual differences were marked, however. Of the 123 minority subjects, about a fourth were entirely independent. The others agreed in varying degrees, a few in every case (Asch, 1955).

Goal formulation. Some organizations seem to exist from force of habit rather than from a sense of purpose. The members of a group should ask themselves: "Why am I coming here? What am I doing that is worth while?" A group that cannot show each member that he has something to contribute and something to gain from membership is an unproductive one and has no reason to continue.

No group, of course, is completely free in setting its goals. Many business, military, and political organizations must work within limitations established by law, economic conditions, or even company policy. But even when group regimentation is as rigid as in prison life there is some latitude for group members to set up mutually acceptable goals. In prison these might be keeping the exercise area clean or maintaining quiet at certain hours.

Flexibility. Often meetings are planned so far in advance that the original interest is lost, or conditions change in some important way between the time of planning and the time of the actual meeting. Plans are not sacred. They should be flexible enough to permit last-minute changes to meet unanticipated interests of the group.

Consensus. Many people believe that democratic action consists in formulating an issue, airing several alternative solutions, discussing the pros and cons of each, and then determining by secret ballot which alternative will be acted upon. In the well-trained participative group, however, no formal voting is re-

quired. In fact, formal voting tends to create factions in a group and to destroy its cohesiveness. In effective group work the members continue to discuss the issue until it becomes obvious that everybody is satisfied with the solution.

Process awareness. As people learn to work as a group—to *be* a group—they become increasingly sensitive to the roles of different members, to the needs of the various members, and to their own needs in relationship to those of the others. People who are relatively insensitive to the needs of others can learn much by paying close attention to the processes of interaction within the group and by relating those observations to their own feelings.

Continual evaluation. A healthy group must know whether or not its activities are those which the members want. Thus it must continually evaluate its activities and goals, making whatever changes are suggested by the evaluation. Because it enables members to get complaints "off their chests," this process of evaluation also has a cathartic value. Without evaluation, the members of a group will tend to lose interest and the group may eventually disintegrate. Dynamic evaluation is not possible under authoritarian leadership.

GROUP-CENTERED LEADERSHIP

Advocates of group dynamics maintain that leadership is a set of functions that can be

distributed throughout the group rather than fixed in a single leader. Some psychologists feel, however, that the group dynamics movement does not take realistic account of the degree to which most groups *do* rely upon a leader, at least emotionally. Even if the group does not formally choose a chairman, one member usually emerges as the tacitly recognized leader.

A slightly modified form of group dynamics, known as *group-centered leadership*, attempts to overcome this weakness of group dynamics by integrating its major principles with certain insights derived from client-centered psychotherapy (Gordon, 1955). The leader's principal goal, according to this school of thought, is to help the group achieve its potential—much as a parent fosters the development of a child. The leader takes an active role, particularly at the beginning, but the needs and abilities of the group are placed first at all times. The leader tries to create a social climate which encourages individual members to participate in group activities and to feel that such participation is rewarding. He recognizes that each member has a different degree of skill and knowledge to contribute to the solution of each group problem, and he tries to make it possible for the group to use effectively the resources of all its members. The one respect in which all members are equal is that each one's feelings and ideas are data which must be taken into account (Thelen, 1954).

EFFECTIVE LEADERSHIP

The group dynamics movement has been particularly valuable in pointing out that leadership is not a mystical quality but a set of skills and attitudes that can be learned. In the next sections we shall examine the responsibilities of a good leader, some differences in leadership technique, and the manner in which good leaders are selected and trained.

RESPONSIBILITIES OF LEADERSHIP

Why do most groups need a leader, and how does the leader contribute to the group's

productivity? Before trying to answer these questions, recall what you have learned about perception. Even simple perceptions involve the structuring and interpretation of stimuli. One person's perception of a situation may differ from that of another because his past experience has been different. Needless to say, the various members of a group are likely to perceive complex social situations quite differently. They may also have different reasons for joining a group and may hope to achieve different goals.

Structuring the situation. The leader's first function is to structure the situation for the group members (Stagner, 1956). First of all, he interprets the situation, with its many ambiguous parts, to his followers—emphasizing certain aspects, ignoring others, and focusing on certain goals. In doing this he must constantly strive for objectivity, or he may deny pertinent facts and distort the data. If the group members accept the leader's interpretation, the group achieves a unified frame of reference. This makes cooperative behavior possible.

The leader's task here is complicated by certain basic conflicts that are inherent in group activity (Thelen, 1954). For example, there is usually some degree of conflict between individual and group needs and between various aspects of the group's activity. How shall the group's time be spent? What problems must be solved first? What goals are most important? The effective leader must be sensitive to such conflicts, help evaluate them objectively, and guide the group toward a satisfactory compromise program.

The problems of leadership are often complicated by the fact that individual members of the group may be trying simultaneously to solve personal problems as well as group problems. For example, they may be using the group primarily to gratify their need for social approval or for dominating others. The good leader tries to set up activities so that both individual and group needs can be met. He helps individual members achieve personal goals while they contribute to the group enterprise.

While a problem is being solved by a group, there is always an uncertainty about future action that some members find hard to tolerate. The leader must guide the group's exploration of data and possible courses of action in such a way as to keep this sense of

uncertainty to a minimum. If he helps the group formulate its problems into specific questions to be answered, he can satisfy the needs of those who crave definiteness and at the same time make it easier for the group to use the facts it has collected.

Controlling group behavior. A second important function of the leader is to control certain types of individual behavior that are against the best interests of the group. In democratic groups this often means that the leader merely enforces the rules made by the group. But sometimes he may himself make rules governing participation in discussion or other activities. He can enforce the rules of the group by using rewards and punishments, ranging from mild expressions of approval or disapproval to much more drastic disciplinary measures—depending on the strength and orientation of his leadership.

The leader must be alert to the dangers both of an individual's exploiting the group and of the group's exploiting an individual. A problem inherent in group activity is that of how much freedom of expression and action the individual members should be allowed. The quality of the group's leadership largely determines whether the rules are aimed chiefly at limiting the situation or limiting the individual members.

Speaking for the group. The leader's third major function is acting as spokesman for the group, expressing their hostilities and fears as well as their aspirations and hopes. In order to do this, the leader not only must be sensitive to the emotions of the group but to a large extent must share these feelings himself. As spokesman he must also be skillful in translating the group's feelings into both words and actions.

KINDS OF LEADERSHIP

Many leadership qualities are common to both authoritarian and democratic types. In performing his complex functions, the leader may use any of four basic methods: *force*, *paternalism*, *bargain*, and *mutual means* (Knickerbocker, 1948). All of these are being used today in particular situations, but some seem generally superior to others.

Force. Leadership by force relies upon fear for its effectiveness. Leaders who rely on force are usually those whose authority has been vested in them by law (as in the case of

the military officer), has been delegated to them by owners (as in the case of a business executive or manager), or derives from personal ownership. Such leaders are sometimes referred to as "headmen" to distinguish them from leaders chosen by the group.

The leader who relies on force uses his authority to satisfy the needs of the individuals in his group as he sees fit and to impose upon them his choice of activities. The alternatives to following the leader are losing some needed satisfaction or being punished. As the spirit of personal freedom has grown, leadership by force has become more and more rare in this country. Even leaders whose authority is independent of group assent tend to avoid force whenever possible.

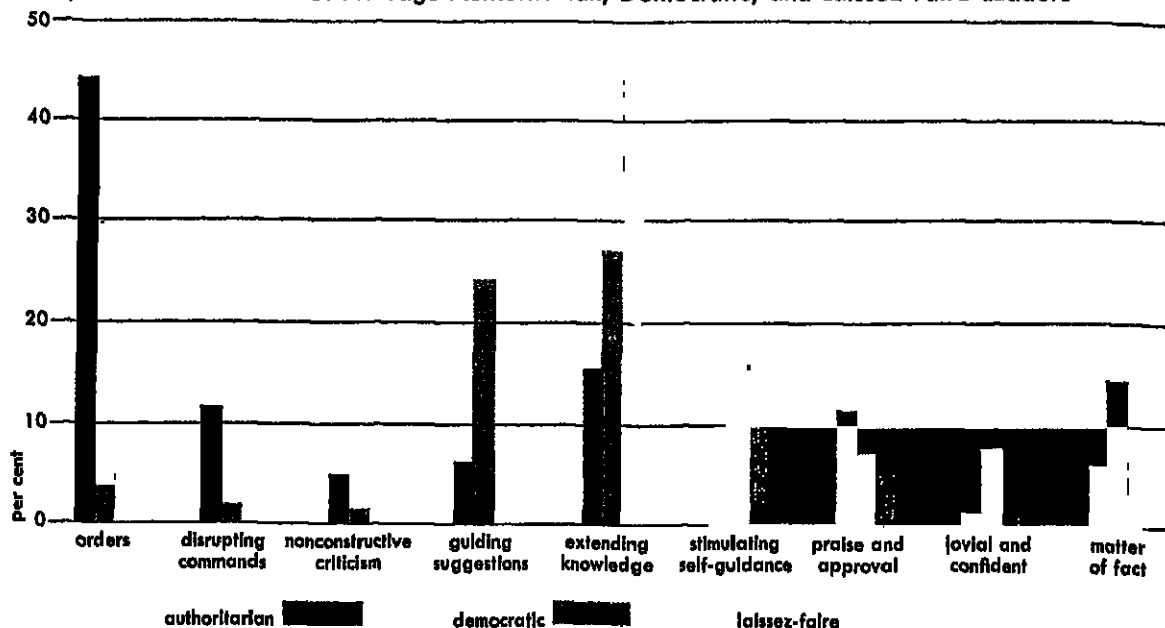
Paternalism. The paternalistic leader tries conscientiously to satisfy the needs of his followers and hopes thereby to gain their loyalty and obedience. Paternalism is still a strong component of modern military leadership. Thus the captain will not eat until the troops have been fed and will not sleep until his men are bedded down.

Paternalistic leadership is also found in many business concerns. Although it is certainly superior to leadership by force that was at one time typical of the relation between employer and employee (particularly of the master workman and apprentice), it tends to be unsuccessful. Paternalistic programs are likely to be resented by the typical American worker—who likes to feel that he has earned his pay, that it is his to do with as he pleases, and that he should receive all he earns with no strings attached. Nevertheless, there is considerable evidence of a trend toward making workers dependent on the government, their employer, or their union for such things as disability benefits, retirement pay, hospitalization, and old age pensions.

Bargain. The concept of bargain was introduced in industry to avoid the use of force by either unions or management. The principle of leadership by bargain is that the leader and the members of his group can work out a "trade" to satisfy the desires of each.

Mutual means. In this more difficult form of leadership the leader creates a situation in which his own activities and those of the group members serve as mutual means of gaining satisfaction for everyone concerned. Elected leaders frequently rely on this sort of leadership. This is particularly true in informal

Comparison of Behavior of Average Authoritarian, Democratic, and Laissez-Faire Leaders



Adapted from White and Lippitt, 1953

organizations where there is no law, force, or precedent to support the leader—where he ceases to be a leader the moment the group members cease to follow him.

The four types of leadership discussed here could be placed on a continuum from *authoritarian* to *democratic*. It should also be apparent that the most democratic form of leadership defined above, that of mutual means, requires a person with greater ability to persuade and with greater knowledge of his job than the less democratic forms. Such a leader can never resort to the simple expedient of saying to a member of his group: "Do as I say or else!"

GROUP REACTIONS TO SYSTEMS OF LEADERSHIP

What effect does the particular type of leadership have on the group? Are democratic methods less efficient than authoritarian, as even many lovers of democracy believe? Or does a group work better under a democratic leader who uses persuasion rather than force, education rather than propaganda, conference rather than command? In an effort to answer such questions, a number of studies have been made of the psychological effects that different types of leadership have on a group. For instance, one striking study has shown that

patterns of aggressive behavior differ under different "social climates" (Lowin, Lippitt, and White, 1939). This study has been summarized as follows:

The investigation "studied the patterns of aggressive behavior in experimentally created 'social climates.' These climates were of three main types, authoritarian, democratic, and laissez-faire. Clubs were formed of boys who, to begin with, were carefully equated, and who were then placed in one of the three experimental groups. In the authoritarian group, for example, all policies were determined by the leader, techniques and activities being indicated by him one at a time so that future steps were always uncertain, and the 'dictator' remained aloof from active group participation except when demonstrating to the others what they were to do. In the democratic group all policies were determined by group discussion, the members were free to work with whomever they chose, and the division of tasks was determined by the group. In the third situation there was complete freedom for group or individual decision, and the leader supplied the information, but took no other part in group discussions. The factor of personality differences in the boys was controlled by having each group pass through autocracy and then democracy, or vice versa. The factor of the leader's personality was controlled by having each of four leaders play the role of autocrat and the role of democratic leader at least once.

"In one experiment hostility was thirty times as frequent in the autocratic as in the democratic group. Much of the aggression was directed toward two successive scapegoats within the group; none was directed against the autocrat. In a second experiment, the boys in the autocratic groups showed less aggressiveness, but their behavior was of an apathetic type. This lack of aggression is interpreted as due to the repressive influence of the autocrat. Among the boys in these groups there were outbursts of aggression on the days of transition to a freer atmosphere, and a sharp rise of aggression when the autocrat left the room. Nineteen out of twenty boys liked their democratic leader better than their autocratic leader, and seven out of ten also preferred their laissez-faire leader.

"This study is of great interest because it submits to experimentally controlled procedures many of the hypotheses which have been suggested as to the effect of various political structures on individual personality. Students of politics, for example, have observed that fascist dictatorships are frequently characterized by the appearance of a scapegoat upon whom all ills may be blamed. . . . This study has revealed that even in an artificial dictatorship of this type such a scapegoat mechanism may easily be elicited. Although value judgments are not usually regarded as within the province of a social psychologist, the apparent superiority of the democratic over the autocratic form of society may be mentioned as one of the important findings of this study" (Klineberg, 1940).

Later studies conducted in classroom situations indicate that democratic methods are generally preferable to authoritarian methods in education. In one study, for example, highly directive behavior on the part of teachers caused a number of undesirable reactions in students, including hostility both toward each other and toward the teacher, withdrawal, aggression, or apathy. Teachers who were more acceptant and student-centered in their approach aroused less hostility and elicited well-integrated emotional responses from students (Flanders, 1951). Student reactions to various leadership techniques in the classroom will be further discussed in Chapter 16.

WHERE DO

GOOD LEADERS COME FROM?

"Ask Dave to be chairman. He's a born leader." We have all heard suggestions like



The autocratic leader directs the operation of the group in great detail, demonstrating and criticizing, but never participating. The group members merely carry out his policies, in which they have had no voice. The work generally proceeds smoothly, but apathetically, since the members tend to feel little responsibility for the project. At times they may develop hostility and scapegoating behavior.

Under a democratic leader, the group members feel a real interest in their project and an incentive to do their best. The reason for this is that they have discussed and planned the work themselves and are encouraged to contribute as much as they can. The leader works with them as a member of the group but has a special responsibility for guidance at certain times.

The laissez-faire leader stands passively by, available for information or help but otherwise aloof from the group. Group interest tends to lag, and individual lines of action emerge unless a spontaneous leadership develops within the group.

this many times. Is Dave really a "born leader," or has he become a leader through training? This question has more than academic interest in our nation, where the problem of obtaining good political candidates, good teachers, good supervisors in industry, and good officers in military organizations is of extreme importance to the security and efficiency of our whole social system.

In the past most people thought that leaders were born with certain traits that fitted them to assume command, and the study of leadership consisted of analyzing these traits. The group dynamics movement, however, has pointed up the fact that leadership is a function of the situation as well as of the individual involved. For example, some situations demand that the member especially skilled in problem solving or particularly qualified to lead some other group activity take the lead. Indeed, different kinds of leaders have been found to differ significantly in personality patterns and to differ also from individuals designated most often by group members as having "leadership qualities" (Cattell and Stice, 1954).

The nature of communication in the group also plays a significant part in determining what kind of person will be an effective leader. An individual will be regarded as a group leader most often when he has a central position in the communication network (Goldberg, 1955). In less highly structured groups persons who initiate the greatest amount of communication are likely to emerge as leaders (Shaw and Gilchrist, 1956).

The group dynamicists also emphasize that although certain personal traits are helpful in leadership, training for the job is essential too. Thus there are two answers to the question of where good leaders come from: they must be *selected* and they must be *trained*.

The selection of leaders. The qualities required of a good leader vary so much from one situation to another that it is difficult to prepare a master list of them. But in most situations leaders are distinguished by at least three important characteristics: their awareness of group attitudes (social perception), their ability in abstract thinking, and their emotional stability. We shall also examine the effects of personal popularity and situational factors in leadership selection.

Awareness of group attitudes. Social perception—or awareness of the feelings, opin-

ions, and attitudes of others in the group—has been demonstrated to be a distinguishing characteristic of the person chosen as a leader.

Four organized groups of college students were selected for study: a religious group, a political group, a medical fraternity, and a medical sorority. Each group was organized around definite interest patterns and each provided an opportunity for face-to-face relationships so that leaders could emerge.

A special attitude questionnaire was administered to each group. The questionnaires were divided into three parts designed to measure opinions at three different levels of relevance to the group's common interests. Every member of the group was requested to make two replies to each item in the questionnaire—(1) to state whether he agreed or disagreed with the item and (2) to estimate the percentage of group members who would agree with the statement.

Sociometric data (measures of social acceptance and interaction) were then collected for each group by having the members answer four questions: (1) Who are the three persons who, in your opinion, are most capable of acting as president of your group? (2) Who are the three persons who, in your opinion, most influence the opinions of the group? (3) Who are the three persons who, in your opinion, are most worthy of acting as representatives of this group at a convention? (4) Who are the three persons in this group with whom you would most like to be friends?

The results showed quite clearly that those designated as leaders were much more able than non-leaders to judge group opinion on issues relevant to the aims of their groups. The ability to estimate group opinion was not evident, however, in material unrelated to the purpose and interests of the particular group (Chowdhry and Newcomb, 1952).

It seems reasonable to suppose that leaders are selected by a particular group because of their ability to judge its members.

It may be necessary to qualify the results of the above study somewhat in the light of a later experiment in which group members were asked to estimate group opinion both before and after group discussion. Leaders did no better than other group members in the beginning, but after group discussion they showed the greatest ability to assess group opinion. The investigator interpreted this to mean that the leaders were influential in forming the group's opinion and hence were better able to predict what it was (Talland, 1954).

Another recent study indicates that leaders are higher than nonleaders in what is called "empathy," the ability to identify with the needs of group members and hence to act in such a way as to satisfy many of those needs.

In this experiment participants in eighteen groups of five members each were asked, after discussion of a problem, to list their preferences for a leader if the group should meet again. At the same time they were given two empathy tests. Those individuals who were most often selected as future leaders received significantly greater empathy scores than did the other members of the group (Bell and Hall, 1954).

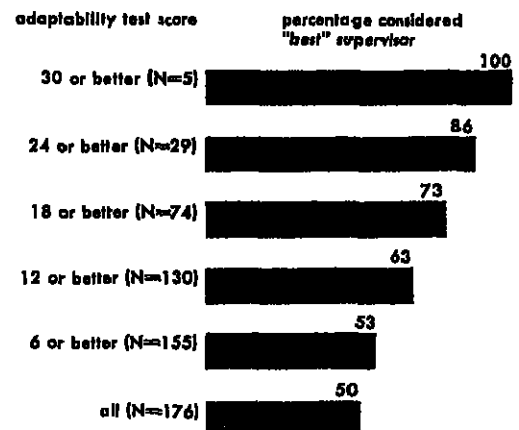
Ability in abstract thinking. Many studies in industrial and military organizations have shown the leader to be brighter than his followers—more capable of abstract thinking. One study has reported that of all the various devices employed in selecting officers for the British Army "... intelligence rating is the most valuable single aid . . . and one could not hope to dispense with it" (Harris, 1949). Studies with officer candidates in the United States Army and with naval cadets have also shown a high correlation between intelligence and leadership (Jensen and Rotter, 1947; Hollander, 1954). Other studies have shown that good industrial supervisors are superior to poor ones in general intelligence (Stockford, 1947) and mental adaptability (Lawshe, 1949). The findings of this last study are shown in the graph at right.

Emotional stability. Emotional stability is another important factor in leadership.

In a study by the British Army it was found that good officers were superior to poor ones in the following personality traits, as appraised in psychiatric interviews: warmth of feeling, spontaneity of expressive behavior, objectivity of social thinking, and cooperativeness of social thinking (Harris, 1949).

Interviews of sorority girls who had emerged as leaders in leaderless discussion groups revealed that they had a much more wholesome concept of themselves than did nonleaders. They expressed many more favorable comments about themselves and their ability to influence others. They also perceived a larger number of things and people as affecting them pleasantly; they regarded their environment as essentially safe and pleasant rather than threatening. Nonleaders, on the other hand, had a poorer self-

Agreement Between Test Scores and Ratings



concept and expressed many more negative attitudes (Gebel, 1954)

One recent study has pointed out an interesting relationship between authoritarianism and leadership choice.

The study was conducted on 268 naval cadets who were asked to indicate the three cadets they considered best qualified and the three least qualified to act as "student commander" of their section. The cadets who were nominated as the best leaders were significantly less authoritarian (as measured by a special test) than those regarded as least qualified. This finding is all the more interesting because it occurred in a military setting, where methods of control tend to be more authoritarian than in most other areas of life (Hollander, 1954).

Since the tendency to be authoritarian usually reveals personal insecurity and anxiety, the results of this study may be taken as indicating that the cadets chosen as leaders had greater emotional stability.

All in all, the evidence is overwhelming that people selected as leaders are superior in emotional adjustment. This relationship is true in a wide variety of situations.

Personal popularity. Although we tend to think that leadership and popularity go together, especially on college campuses, experimental evidence does not bear this out. The person chosen as leader is not always the best-liked member of a group. In fact, one study has shown a low correlation between leadership and friendship and a high one between

leadership and followership, though in popular opinion leaders and followers are opposites (Hollander and Webb, 1955).

Another recent study investigated the importance of power versus friendliness as factors in leadership selection.

A group of six psychology students were each given a card with the names of four different psychologists. Twelve of the twenty-four names used were easy to identify—Freud, Binet, etc.—but the remaining twelve were less well known. Although the subjects were to be graded individually, they were permitted to cooperate in writing a description of the activities of the psychologists listed.

Four subjects were "naïve"—that is, they knew nothing of the nature of the experiment and believed they were being graded on the descriptions. The other two were asked to play a role in the group and believed they would be graded on this. Subject J was secretly given information about all the names but was instructed to behave in a very uncooperative manner and withhold his help as much as possible. However, if the group insisted, he was to give the proper solution in an unfriendly, authoritative way. Subject K, on the other hand, was instructed to be exceedingly friendly and helpful but to display complete ignorance of the subject matter, giving wrong answers even when he knew the right ones. Later the subjects were asked to fill out a rating sheet indicating (1) which members had contributed most and which least to the performance of the task, (2) which ones they would and would not like to become better acquainted with, (3) which they would and would not want to have in the group a second time, and (4) which they would choose to be chairman.

Both role-playing subjects gave a good performance. Subject J was haughty and aggressive, constantly informing the group that they would have known the answers if they had done their work properly. Meanwhile, Subject K smiled constantly and even gave candy and cigarettes to other members. When shown to be in error he would be apologetic and say, "I am not saying that I know the answers specifically." The group ranked J high in amount contributed. Most of them said they would want him in the group again and would choose him as leader, in spite of the fact that he was not accepted as a potential friend. His power to help them meet their needs in performing the group task was more important than his personal popularity in determining whether he should lead. K, on the other hand, was not desired as a leader, although he was well liked (Wolman, 1956).

In real life, fortunately, such extreme divergence between power and likability is seldom found, so that leadership and popularity often do go together—even though they are not necessarily related.

Situational factors. In recent years there has been considerable interest in the question of whether leaders who emerge with the approval of the group are different in personality and ability from those of the "headman" variety who are assigned by some outside authority. The available evidence indicates that these two types of leaders have essentially the same characteristics.

In one experiment a total of forty subjects were observed in two leadership situations. The subjects met in groups of four members and worked on three different tasks—reasoning, mechanical assembly, and discussion. At the first meeting the subjects were placed in a leaderless group situation and were then observed and rated for the amount of leadership they displayed. At the following meetings each group had a formally appointed leader whose leadership performance was also observed and rated. Each of the subjects served at one time as the formally appointed leader. The correlation between the subjects' rated leadership performance in the leaderless situation and that in the appointed-leader situation was .65 (Carter, 1951).

Evidently, the person who emerges as the natural leader of the group is the one who is most likely to succeed when the assignment of leadership is thrust upon him.

Another question raised in connection with the search for personality characteristics of leaders is whether there is a general quality of leadership. For example, can the person who is a natural leader in one group be expected to emerge as the leader of a different group working with a different problem? A recent experiment studied this question.

Twenty-five male students in a beginning psychology course were used as volunteer subjects. Each participated in a series of discussion groups made up of five subjects who had never met previously. Over a period of six weeks each man appeared once and only once with every other man. The topic for discussion was what to do about a particular student adjustment problem, a different problem being discussed in each group. At the end of each session the members of the group were asked to nominate a discussion leader for a hypothetical

second meeting of the same group. The leadership rankings given by each individual were transformed into scores which could be correlated, and the correlations were computed. From these it was found that the average coefficient of determination was .83. In other words, only 17 per cent of the variance in leadership status could be attributed to changes in the composition of the group (Bell and French, 1950).

In this experimental setup, leadership was more a matter of individual than of situational variance. It must be remembered, of course, that the situations here were all relatively similar (discussions of student adjustment problems) and that the subjects were all similar (male volunteers of about the same age, all beginning psychology students). With a wider range of tasks and more varied memberships in the different groups, we would expect the situational variance to be somewhat greater.

The training of leaders. One study has shown the efficiency of certain methods for rapid retraining of leaders in a particular field. Six mediocre leaders on a WPA project for children were chosen as subjects.

Three of the six subjects were given retraining and three were not. The members of the experimental and control groups were equated on the basis of age, sex, length of time on WPA, length of time on present WPA project, rating of technical skill, rating of leadership ability, and relevant facts in their life histories. Those who were selected for retraining took part in a series of group discussions. The group leader was the experimenter, whose conduct was illustrative of the type of leadership in which the three subjects were being trained. The training meetings took up the following points.

1. The underlying attitudes and general principles of recreational group work were discussed in preference to the question of what to do in particular situations. Thus the leadership techniques learned were not a "set of tricks" but were flexible and could easily be modified to meet each new and specific situation.

2. The qualities of a good leader were listed and were defined in relation to how a particular leader in the group stood up under the check list. Not only were concepts of leadership clarified, but the leader's possibilities for action were elaborated.

3. The group made a concrete formulation of the objectives of their work. This restructuring of goals led to a re-evaluation of the best techniques for attaining those goals.

4. The subjects learned suitable techniques of leadership by observing the trainer leading a group, by observing and evaluating each other, by viewing film records of experiments in various kinds of leadership, and by acting as "children" themselves while the trainer used various methods.

One important result of training was to improve the morale of the retrained leaders. At the start they had not felt very involved in their work and had done only as much as was necessary to keep their jobs. Toward the end of the experiment these same leaders showed absorbed interest in their work, went to considerable effort and expense to help their groups get materials, and willingly committed themselves to long-range plans.

A second result of the training was to improve the morale of the children's groups. These developed a constant membership and showed great initiative in reaching new levels of productivity.

Some of the changes in leadership method brought about by training are shown below. The untrained leaders continued using methods like those of leaders A, C, and E before training (Bavelas, 1942).

Trained leader	Before training		After training	
	Use of authoritarian methods	Use of authoritarian methods	Use of democratic, initiative, stimulating methods	
A	77%	4%	73%	
C	77	7	73	
E	51	11	89	

The best method for training leaders may vary in certain details from situation to situation. Nevertheless, the experiment described here suggests several useful principles of leadership training—and offers dramatic evidence as to the effectiveness of such training.

COMPETITION AND COOPERATION

Earlier in this chapter we noted that many tasks can be accomplished more efficiently by cooperative group action than by individual effort. But our everyday observations tell us that in many cases group activity seems to be characterized by competition rather than co-

operation. In fact, many people maintain that individuals in a group will *naturally* compete and should be encouraged to do so—that children will learn more, that business will thrive, and that nations will become great under the incentive of competition. Those opposed to this view hold that competition is too often destructive, that lasting and constructive accomplishments are possible only through cooperative activity. Clearly, two questions are involved in this issue: (1) Is there an “instinct” of competition? (2) What are the effects of competition and of cooperation?

IS THERE AN “INSTINCT” OF COMPETITION?

The question of whether the urge to compete is inborn has profound social significance. In the United States, with its tradition of individualism, the competitive race continues all through life. We are often made to feel that we should do better than anyone else: be first in school, captain of the baseball team, a member of the “best” fraternity, the boy friend of the most popular girl on campus, the owner of the biggest house and the newest car on the block. It is obviously impossible for everyone to reach these goals. Most people are “average”—better in some things and perhaps below average in others.

Anthropologists are pretty well convinced from their studies of various cultures that *competitiveness is learned rather than inborn*. This conclusion is supported, for example, by studies of the Hopi Indians of the Southwest

and the Kwakiutl Indians of Vancouver Island. These two groups lived under strikingly different environmental conditions and developed equally striking differences in their cultures as regards competition and status-seeking.

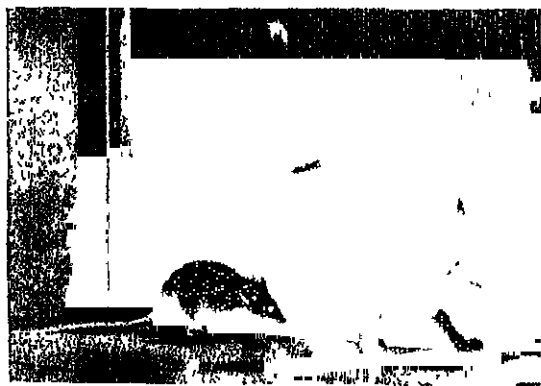
Cooperation is highly valued in Hopi culture, where farming is the principal means of livelihood and where cooperative irrigation projects are necessary to farming. Competition and aggression, on the other hand, are consistently discouraged. Children are taught not to seek the limelight, and the person who wants to win or become outstanding in any way often becomes an object of ridicule (Goldfrank, 1945).

The situation among the Kwakiutl was very different. These Indians lived under conditions of relative economic plenty but engaged in intense and bitter rivalries. Personal wars were waged through *potlatches*—feasts at which large quantities of food and other property were given away or even destroyed. The individual's prestige was measured in terms of the amount of goods he gave away. Gifts were used as weapons, since the receiver of a gift at a potlatch was obliged to return a bigger one or to suffer shame. Life was a constant competitive battle, always threatening defeat and dishonor. Even nature was suspiciously regarded as a potential dispenser of insult (Benedict, 1934; Goldman, 1937).

Even in cultures like these, where cooperation or competition is highly stressed, individual or subgroup motivation may differ greatly from the cultural norm. This has clearly been brought out in a study of the Hopi.

To see if Hopi children would demonstrate competitive responses in situations where their actions were unknown to the rest of the group, the investigator used two tests. In the first, subjects were asked to make marks in circles and to traverse printed mazes with their eyes closed; but they were not closely watched, so that they could easily cheat. Maximum honest scores had been established by using blindfolded subjects; scores in excess of these were therefore taken as indications of cheating. Forty per cent of the Hopi children cheated, presumably in order to make better scores than their fellows. This was somewhat less than the percentage of cheating in a controlled group of white children.

In the second part of the study, the children were asked a number of preference questions, including whether they would prefer to make the best grades in the class or make the same grades as most of the others; whether they would rather run a race for a



Even the cat and the rat, traditional enemies, can learn to cooperate, as was demonstrated in an experiment in which both had to press levers simultaneously in order to obtain food.

prize or just for fun; whether they would like to be the tallest in their class or the same height as most of the rest; and so on. Sixty per cent of the boys and 79 per cent of the girls preferred to make the best grades. Seventy-two per cent of the boys and 63 per cent of the girls preferred to run a race for a prize. On this test, in fact, the Hopi gave more competitive answers than did the white children. Evidently, individual motivations were partly competitive in spite of the prevailing cultural pattern (Dennis, 1955).

Psychologists feel that all-out competitiveness is not an inborn trait. They maintain that we can teach children to compete or to cooperate or to achieve a balance between the two (Vaughn and Diserens, 1938). This conclusion has been supported by animal experiments as well as by cultural studies.

In one experiment a box containing food was placed outside the cage of two chimpanzees. The box could be hauled in by a rope but was too heavy for one animal to pull in alone. Given food as a reward, the two chimpanzees soon learned to pull together to bring the box within reaching distance of the cage. The chimps learned to help each other even when one of them was not hungry (Crawford, 1937).

In many areas of life the spirit of competition is mixed with that of cooperation. Businesses, for example, compete with one another for customers but cooperate through chambers of commerce and other organizations that are intended to promote their common interests. Boys compete for a place on the football or basketball squad but work cooperatively for the success of the team and the school.

EFFECTS OF COMPETITION AND OF COOPERATION

How do competition and cooperation affect the kind and amount of work accomplished by individuals and by the group as a whole? How do they affect the character of the group? What are the effects of competition and cooperation on the personality of the individual? We have already demonstrated the effectiveness of cooperative activity in group problem solving, but is cooperation always preferable to competition?

Competition as incentive. Individual competition has been used extensively in the

schools to stimulate students to greater effort. Most schools, for example, prepare "honor rolls" of students who have never been absent or tardy or who have done particularly well in their studies. Children take such honors very seriously and strive hard to be included in the select list.

But is competition really effective as an incentive to learn? Various studies have investigated this question. Some investigators have concluded that classroom groups perform most effectively under *cooperative* conditions (Deutsch, 1949; French, 1951); others have shown that *competitive* conditions improve performance (Hurlock, 1927; Leuba, 1933). One important factor seems to be the kind of competition used.

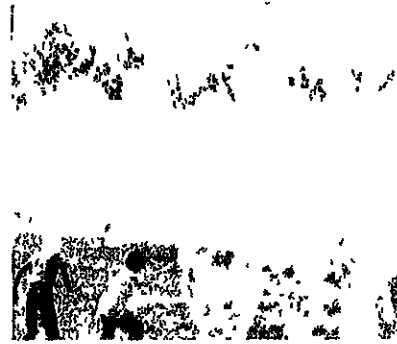
One early investigation studied individual and group competition as factors motivating schoolwork. Simple addition was selected as the task. Of the children studied, 65 per cent showed greater speed in doing the problems when working for themselves, whereas 35 per cent showed greater speed when working for the group. Boys persisted longer than girls in working for the group, but girls persisted longer than boys in working for self.

On the basis of this experiment and others, the investigator concluded that the conditions motivating school children can be arranged in the following order of strength: (1) boys working against girls as individuals, (2) working for self, (3) working for the team, (4) working in partnership, (5) working for the classroom as a whole, (6) working for a group picked arbitrarily by an outsider (Maller, 1929).

These, of course, are average results. As with older people, some children thrive in a highly competitive atmosphere; others are motivated more effectively by ideals of service.

The effect of competition on performance depends too on the kind of task involved. There is evidence that, with simple tasks, most individuals produce a *greater quantity* of work in a competitive situation than in a noncompetitive one but that the work is of *poorer quality* (Whittemore, 1924). Again the results always depend upon the individual involved and upon the intensity—and spirit—of the competition. A little later we shall discuss some of the ways to use competition most effectively.

Effects of competition on the individual. Although competition often increases productivity, it sometimes has unfortunate effects upon the individual. Too great an emphasis



In a recent study friction was generated between experimentally created groups and was later overcome as the groups worked toward common goals. Twenty-two normal boys about eleven years of age, with homogeneous backgrounds, were divided into two groups on the basis of such factors as size and various abilities. Before arriving at the summer camp where the study was conducted, the boys did not know each other; and they remained unaware that an experiment was taking place.

To cement the boys into true groups, the experimenters introduced problems requiring group solution, such as fixing meals from unprepared food and carrying canoes from the bunkhouses across rough terrain to the lake. The group spirit that developed supported the hypothesis that (a) a definite group structure will result when individuals are placed in situations involving appealing goals and requiring cooperative effort for attainment; and (b) as this group structure is formed, norms regulating behavior and group activities of the individuals will become standardized.

Next, rivalry between the groups was stimulated by a series of competitive events. As predicted, this

increased in-group solidarity and produced unfavorable stereotypes of the out-group and its members. In-group democracy and cooperation did not extend to the out-group. After losing a tug-of-war, the Eagles burned the Rattlers' flag. The Rattlers retaliated, and a series of bunkhouse raids ensued, accompanied by name-calling and other expressions of hostility. During the conflict, a physically daring leader emerged to replace the less aggressive boy who had led the Eagles, indicating that relations with other groups will cause changes within a group.

One other interesting fact concerned a second tug-of-war. The Eagles used the strategy of sitting down and digging their heels into the ground. After losing ground the Rattlers resorted to the same tactics. Although an extra fifteen minutes was added to the forty-minute deadline, the Eagles were unable to pull the Rattlers over the line, and the contest was called a tie. When asked the next day how long the contest had lasted, the indignant Eagles gave their estimate in minutes, ranging from twenty to forty-five, while the Rattlers, who had accepted the outcome with relief, gave theirs in hours—from one to three and a half. (See page 287.)

on competition tends to make both children and adults want to win at any price—even through dishonesty. There is an even greater danger that preoccupation with the competitive aspects of the school situation will blind many students to the less tangible but more fundamental goals of education.

Another important consideration is the effect of discouragement on the loser. There must always be a loser if there is to be a winner. Does the person who loses consistently continue to work hard even though he knows that somebody else will get the prize? As we have seen in earlier chapters, discouragement or failure tends to reduce one's later efforts.

Even the winner in competition may suffer, for success may mean hurting his competitors as well as reaching his goals. He may want to succeed but be afraid that by succeeding he will lose popularity. This is an example of the "conflict frustration" we discussed in Chapter 7. Like many other conflicts, it may be at an unconscious level.

How can an individual overcome the evils of excessive competition? The first step is to appraise oneself to discover one's special abilities and talents. However discouraged a person may be about himself, there are always some activities in which he can win at least a degree of success and respect. Studies show that people tend to protect themselves from



In an attempt to achieve intergroup cooperation, the rival groups were then brought into close contact in pleasant activities such as eating and shooting off firecrackers. But this merely provided an opportunity for such expressions of hostility as throwing mashed potatoes, indicating that intergroup contact does not in itself decrease tension.

The successful method involved bringing about interaction of the groups to achieve superordinate goals—that is, important goals which could not be achieved without the combined efforts of both groups. In one problem situation the experimenters cut off the camp water supply and elicited the cooperation of all the boys in locating the trouble. For a time friction continued, however; after cooperating to procure a film, for example, the boys still sat primarily with their own groups while viewing it.

The most striking episode in this period was one in which the tug-of-war rope, formerly the central object in a most antagonistic situation, served as a tool. On an overnight trip, a truck which was to bring their food "stalled," and the boys hit upon the idea of using the rope to pull the vehicle. After looping the rope through the bumper, the two groups pulled on

different ends; but the next day, when the truck "stalled," members of both groups intermingled on the two lines, obliterating group divisions.

This part of the experiment supported two more hypotheses: (a) when groups in a state of friction are faced with conditions embodying a superordinate goal, they will tend to cooperate to achieve it; (b) cooperation in attaining a series of such goals will gradually reduce intergroup tension.

Further evidence of the change in the boys' attitudes was obtained from sociometric choices made at the end of the period of intense competition and again at the close of the experiment. Rattlers' choices of Eagles as friends went up from 6.4 to 36.4 per cent of their total friendship choices. Eagles' choices of Rattlers went up from 7.5 to 23.2 per cent. The boys were also asked to rate their comrades on six characteristics designed to bring out the presence of stereotyped images. During the period of antagonism, Eagles received few favorable ratings from Rattlers, and Rattlers few from Eagles; but at the close of the experiment there was no significant difference in the ratings of in-group and out-group members (Sherif and Sherif, 1956).

the bad effects of repeated failure in competitive situations by lowering their "level of aspiration" to some point within reach.

Each member of a large class of students was asked to state the grade he expected to receive on an important test to be held the next day. Exactly half of the students reached or surpassed their level of aspiration. When the second important test came along, the students were again asked to state the grade they expected to receive. Of those who had failed to reach their expected grade on the first test, 34 per cent lowered their second aspiration to the grade actually received the first time; 66 per cent restated their original aspiration. Of those who had succeeded in reaching the expected grade in the first

test, 62 per cent restated their levels of aspiration for the second test; 36 per cent raised them; and 2 per cent lowered them (Pennington, 1940).

Once attainable goals are set up, an individual does not feel so unsure of himself that he must compete excessively. Another effective way to eliminate much of the emotional tension caused by competition is to follow the rules of fairness and good sportsmanship when competing. The person who does so will not experience the same guilt over winning or inferiority over losing as the person who resorts to "cutthroat" competition.

Effects of competition on the group. The effects of cooperation and competition upon



This chemistry class shows one way in which effective competition is planned for in high school. The class is divided into small groups which work together on an experiment, and competition develops among the various groups.

the behavior of small groups were studied recently in an experiment in which subjects were permitted to communicate only during three note-writing periods.

At the beginning of the experiment, some of the subjects received "planted" messages that made them regard the experiment as a cooperative enterprise; the rest of the subjects received messages that made it appear competitive. Results showed that cooperative subjects showed more cohesive behavior, made more attempts to influence other members, exerted more pressure toward uniformity, and sent more relevant communications than did competitive subjects. Most of their communications concerned information and opinion about the experiment. The competitive subjects sent more messages expressing tension and antagonism. Cooperative subjects also received more communications. In general, the experiment indicated that an individual's frame of reference will determine what he expects of others—that is, a person who perceives himself as cooperative will tend to expect cooperative behavior from others, whereas individuals who perceive themselves as competitive tend to expect competitive behavior from one another (Grossack, 1954).

Planning for effective competition. There are several plans for utilizing the incentive value of competitive conditions and at the same time minimizing or altogether eliminating the undesirable effects of competition. Most of them are based on classroom experience, but often they can be adapted to other situations.

One plan is to rank the members of the group, on the basis of their initial performance, from best to poorest. Rewards are then made on the basis of greatest *improvement* in rank. This scheme affords ample opportunity for the poorer performers to share in the pleasures of winning. At the same time it stimulates the better performers to improve their performance rather than "rest on their laurels."

Another widely used scheme is that of dividing the group into various subgroups made up of individuals who are about evenly matched in ability. This arrangement actually tends to strengthen the incentive value of competition, for people are most strongly motivated when they know they have a chance to win—or to lose. At the same time, because success will be distributed throughout the group over a period of time, the undesirable effects of competition on interpersonal relationships will largely be averted.

Often teams can be used to "distribute the risk" in a competitive situation—as is done, for example, in team sports and in the formation of sales teams. The frustration of failure is lessened when there are others to share it with, and the joys of victory are increased.

Unfortunately these suggestions apply chiefly to relatively simple work, study, and play situations in which the goal is readily discernible and in which progress can be measured objectively. Most of our relationships with other people depend upon our ability to adjust to competitive situations rather than on formal arrangements and rules.

There are some indications today that the pattern of our culture is swinging away from the extreme competitiveness that characterized our young, expanding, individualistic economy fifty years ago. The problem of reducing competition—or of utilizing it more effectively—will not be easily solved, however, for it involves our whole social tradition.

S U M M A R Y

Man's ability to communicate what he has learned is perhaps his greatest asset. Today there is great interest in *information theory*, the principles that make for understanding, control, and predictability in communication.

All communication systems consist of five basic parts: (1) a *source* which encodes the information by means of (2) a *transmitter*, (3) a *channel* which carries the coded signal, and (4) a *receiver* which decodes the information so that it is usable at (5) its *destination*.

To be effective, communication must be a two-way street; there must be *feedback*, so that the person transmitting information can know the reaction of the person receiving it. The extent to which communication in a group is free or restricted has a definite influence on the effectiveness with which the group can organize and carry out a program of cooperative effort.

Research into group relations is a vital task of modern psychology. It has been established that, with adequate intercommunication, groups can solve many problems and achieve many goals more successfully than can solitary individuals. In group effort *communication patterns* influence both overall efficiency and individual morale.

Group behavior is the result of dynamic interaction between individuals in a social situation, and *group dynamics* can do much to make cooperative activities more democratic and more effective. Effectiveness can be improved by establishing (1) an informal workshop *atmosphere*, (2) feelings of security through *threat reduction*, (3) *distributive leadership*, (4) a sense of purpose through *goal formulation*, (5) *flexibility* in plans, (6) true *consensus*, (7) *process awareness*, and (8) *continual evaluation*. *Group-centered leadership* recognizes the value of a single leader whose chief goal is to help the group achieve its potential.

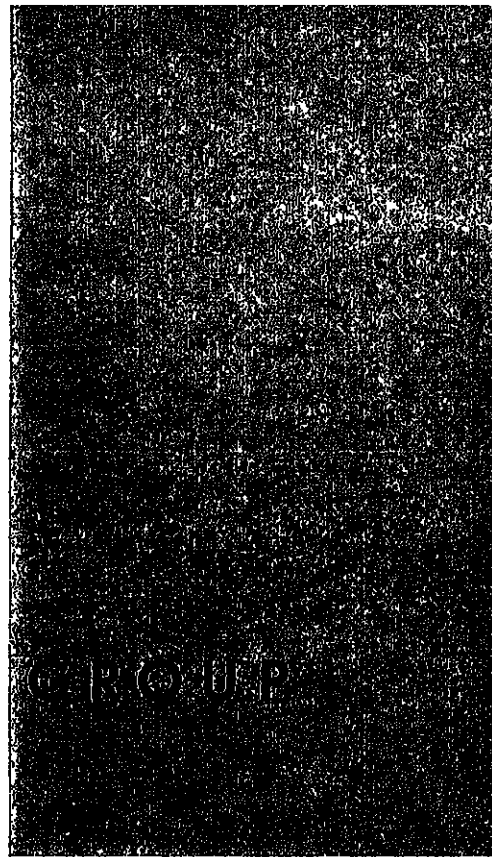
The effective leader has three basic functions. He must structure the situation the group faces, providing a unified frame of reference, he must control the behavior of the group; and he must be able to speak for the group. In performing his functions, he may use any of four basic methods: *force*, *paternalism*, *bargain*, and *mutual means*—representing the range from *authoritarian* to *democratic*. Democratic methods usually achieve better results than authoritarian methods.

Leaders must be selected, and they must be trained. In most situations a leader has three major characteristics: awareness of group attitudes, ability in abstract thinking, and emotional stability. Leadership and personal popularity often go together, but they are not necessarily related. In general, leaders chosen by the group and "headmen" assigned by outside authority have the same characteristics. The training of leaders improves the morale of the leaders and of their groups.

Anthropologists and psychologists believe that *competitiveness* is learned rather than inborn. The effect of competition on performance depends on the individual and on the task. The unfortunate effects of competition on the individual can be avoided if the goals set up are attainable and if the rules of fair play are observed. Various ways have been suggested for utilizing the incentive value of competitive conditions while lessening the undesirable effects of competition in group situations. One plan involves rewarding improvement rather than rank; another recommends setting up subgroups of individuals of equal ability. However, most of our relationships depend upon our ability to adjust to competitive situations.

CHAPTER FIFTEEN

PROBLEMS IN LIVING



PROBLEMS OF MARRIAGE

PROBLEMS OF ILLEGAL BEHAVIOR

PROBLEMS OF PREJUDICE



Few of us will ever find ourselves in the role of a Robinson Crusoe living on a desert island without human company. From the time we are born we live with other people. Our happiness depends in large measure on our success in various areas of interpersonal relationships—in the home, in social groups, in business, in various political units.

This chapter will examine some of the major problems in group living in light of the known facts about human relationships. What are the factors responsible for success or failure in marriage? What conditions make an individual adopt illegal behavior, and what can we do to correct those conditions? What are the causes and cures for prejudice? These questions are vital in everyday living. Although we are still a long way from being able to answer them fully, psychologists and other social scientists have made important progress in this direction.

PROBLEMS OF MARRIAGE

The institution of marriage is of fundamental importance in our culture. It provides for the satisfaction of such basic needs as those for companionship, affection, and sexual expression. Marriage and the home provide an ideal situation for procreation and the rearing of children. The family is also the basic economic unit in our civilization and makes possible a division of labor between wage-earning and homemaking.

In recent years, however, the traditional pattern of permanent monogamous marriage has been challenged. In the United States the rate of divorce has increased by more than three times since 1848; in northern Europe it has increased by more than five times. Adding to the picture of unstable marriage are about 2.3 million American couples who, though not legally divorced, are separated (Bureau of the Census). The table on page 401 shows how the rate of divorce has increased in the United States since 1900.

An important step toward avoiding a broken marriage is to examine the possible causes of marriage failure.

WHY MARRIAGES SUCCEED OR FAIL

Marriage and family life, like any other career, involve the close cooperation of two or more persons. Success in marriage is partly a matter of *finding* the right person and partly of *becoming* the right person. Some people, as shown by their multiple divorces, seem to lack the aptitude, skill, and temperament required for marriage. In other instances, two persons who are poorly suited to each other may find happiness with different marriage partners. And two seemingly incompatible persons can often learn to get along with each other. Many of the factors in marital adjustment have not yet been identified, but some are well enough understood to merit discussion.

Length of courtship. Courtship has long been regarded as very important to success in marriage. During this period a couple has the opportunity to become well acquainted, to discover areas of agreement and disagreement, to learn the necessity of cooperating. What happens when this important period of



Many couples marry with little knowledge of the factors which are essential to marital happiness. Marriage counselors at clinics like the one directed by Dr. Clifford Adams at Pennsylvania State University (above) can often help a married or engaged couple achieve a more successful marriage by discussing their motives and problems with them.

getting acquainted is cut short and a couple marries without having really tested their ability to get along?

Length of engagement was one factor included in a recent comprehensive study of divorce in which 425 divorced mothers in the very remarriageable age group of twenty to thirty-eight years were selected for study from several thousand Detroit divorce-case court records. To determine the nature of the courtship period, the marriage itself, and the cause of the divorce, the investigator and his assistants questioned each of the mothers in an exhaustive interview including about two hundred questions and lasting several hours. In most of these instances the couples had known each other a year or more before marriage, and the longer they had been acquainted the longer the marriage lasted. However, the engagement period was shorter than six months in 71 per cent of the cases and nonexistent in 19 per cent. In general, longer engagements resulted in longer marriages (Goode, 1956).

Another study, of a random sample of 1434 divorces granted in Philadelphia County over a fourteen-year period, showed that hasty, runaway marriages tend to end in divorce (Kephart and Strohm, 1952).

Statistics indicate that the divorce rate is high immediately after a war; then after a year or two it drops quite rapidly. This was

true in the periods following both World War I and World War II. Two hypotheses explain postwar marital instability. The first is that the spirit of the times is responsible, that the general unrest and uncertainty existing in wartime are conducive to mismatings and hence to divorce. The second hypothesis is that the shortness of the engagement period is responsible for the instability of such marriages. The balance of evidence is that both factors operate, although the former is definitely more important (Terman *et al.*, 1938; Burgess and Cottrell, 1939).

Early marriages vs. late ones. One factor commonly believed to affect the success of marriage is the age of the couple when they marry. Very young people are supposed to be too irresponsible and older people to be "too set in their ways." Is there any basis for these beliefs?

In a recent and comprehensive study 525 persons who were already divorced or were in the process of obtaining a divorce were compared with 404 happily married persons. In this study the optimum marriage age for women was found to be between twenty-one and twenty-nine years. Those marrying before and after these limits had a poorer chance of being happy. The best ages for men were between twenty-four and twenty-nine years (Locke, 1951).

Other studies have also reached the conclusion that marriages contracted before the age of twenty or twenty-one are comparatively risky (Terman and Buttonwieser, 1935; Burgess and Cottrell, 1939).

A recent study of emotional factors involved in marriage would appear to throw some light on the question of early marriages. The investigator felt that persons who are least mature emotionally are the ones to whom marriage appeals most. If this were true, people who were least capable of making a marriage successful would be the same ones who tended to marry first.

To test this hypothesis the investigator employed personality test results of 604 girls who had taken the tests during high school and had graduated in the years 1945 through 1949. By 1950, 131 of the girls had married. Each of the married girls was paired with a single girl in respect to age, nationality, father's occupation, intelligence, and a number of other factors. As predicted, personality test scores favored the single girls, who reported better health

adjustment and emotional adjustment and who were more aggressive socially. The girls who had married seemed to have greater feelings of "ego deficiency"—that is, a greater tendency to withdraw or to depend upon others (Martinson, 1955).

Since none of the girls could have been much more than twenty-two or twenty-three years old at the time of the study, it is highly probable that most of the better adjusted ones would also have been married had the study been conducted five years later. But the results seem to indicate that the poorly adjusted girls were the ones who married early. If early marriage tends to be a sign of emotional dependency, it is not surprising that many early marriages fail.

On the question of whether late marriages are more or less likely to be successful, the findings have been somewhat controversial. Some studies have concluded that age at marriage is of little or no importance after twenty-one (Terman and Bittenwieser, 1935; Burgess and Cottrell, 1939).

One early study even concluded that marriages contracted after thirty have an increased chance of being successful. It is possible that the results of this study were influenced by the selection of subjects, who, as a group, were decidedly above average in socio-economic status. The greater proportion of marital unhappiness among those who married early might therefore be related to thwarted professional ambitions or economic difficulties. In any case, the finding that late marriages are most likely to be successful cannot be regarded as conclusive. One recent study found very different results.

An analysis was made of the relationship between age at marriage and duration of marriage for all couples obtaining divorces in Wisconsin during the five calendar years 1915, 1920, 1935, 1940, and 1945. It was found that women who had married at thirty or older and men who had married at thirty-five or older had the shortest mean duration of marriage (Tarver, 1951).

Obviously the problem of marrying age is a complex one requiring further study. Thus far it seems safe to conclude that marriages contracted before the partners are twenty-one are more likely than average to fail; but on the question of whether there is a *best* age for marrying, the evidence is inconclusive.

Proportion of Marriages Ending in Divorce

Year	Marriage rate per 1000 population	Divorce rate per 1000 population	Proportion
1900	9.3	0.7	7.5
1905	10.0	0.8	8.0
1910	10.3	0.9	8.7
1915	10.0	1.0	10.0
1920	12.0	1.6	13.3
1925	10.3	1.5	14.6
1930	9.2	1.6	17.4
1935	10.4	1.7	16.3
1940	12.1	2.0	16.5
1942	13.2	2.4	18.2
1943	11.8	2.6	22.0
1944	11.0	2.9	26.4
1945	12.2	3.5	28.7
1946	16.4	4.3	26.2
1947	13.9	3.4	24.5
1948	12.4	2.8	22.6
1949	10.7	2.7	25.2
1950	11.1	2.6	23.4
1951	10.4	2.5	24.0
1952	9.9	2.5	25.2
1953	9.8	2.5	25.5
1954	9.2	2.4	26.1
1955	9.3	not available	

Age discrepancies. Most people prefer to marry someone of approximately the same age, with the female partner a little younger.

In a study in which college students were asked if they wanted their mates to be older, younger, or the same age as themselves, only 24 per cent of the men wanted a wife the same age, while 75 per cent wanted the wife to be younger. Their median preference was three years younger. The girls expressed an overwhelming (94 per cent) preference for an older husband, their median figure being five years. However, they did not want the husband to be more than ten years older (Baber, 1953).

These preferences are ordinarily carried out in first marriages, as shown by the fact that the median age of brides in 1955 was about two and a half years younger than that of grooms (Bureau of the Census).

Many people believe that marriages between persons divergent in age are destined to turn out badly. Study shows, however, that even if age differences between husband

and wife are considerably larger than average, this factor is not related in any important degree to happiness in marriage (Locke, 1951).

Education. While it is true that most men marry girls who have had less formal education than they, the more educated a man is, the greater his tendency to select a wife of above average education. Similarly the more educated girl is likely to marry a man of superior education.

In one recent study in which 642 college students were asked whether they would prefer their mates to have less, more, or the same education as themselves, 78 per cent of the men preferred equal education and 17 per cent wanted the wife to have less (Baber, 1953). In another study of 559 students, 60 per cent of the men wanted equal education and only 3 per cent wanted the wife to have less (Komarovsky, 1946). In neither study did the girls want husbands with less education. Instead, over half the girls wanted their husbands to have more education than themselves.

Here is a social pattern so sharply defined that to deviate from it by marrying a person greatly different in degree of education would appear to jeopardize the chances of happiness.

It has also been found that men and women with a high level of education have a higher level of marital adjustment than those with little education (Locke and Sabagh, 1957).

Religion. The effect of differences in religion upon success in marriage is a topic of

considerable concern to college students. In these days of social mobility it is inevitable that men and women of different religions will meet and become attracted to each other through the associations of schools, jobs, military service, or in the social life of their communities.

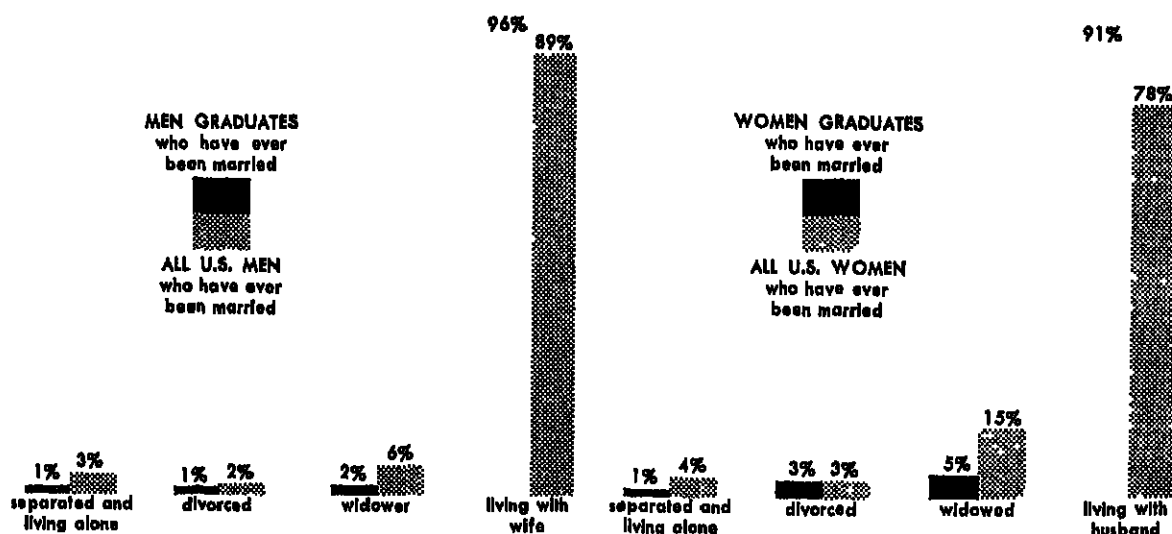
Most studies fail to reveal religious differences as being a major source of failure in marriage (Locke, 1951). Apparently religious differences that would be great enough to disrupt a marriage are generally great enough to prevent the marriage from ever taking place.

Marital adjustment of parents. In earlier chapters we have noted the relationship between the emotional adjustment of succeeding generations. It is not surprising, therefore, that happy marriages seem to run in families (Locke, 1951). Happily married parents usually give their child the kind of upbringing that will insure his ability to get along in marriage when he becomes an adult. Children who come from unhappy homes, on the other hand, are more likely to have marriage failures of their own.

Premarital sex relations. One study has indicated that in the case of both men and women, there is a low correlation between nonvirginity at time of marriage and the happiness of the marriage (Terman *et al.*, 1938). A more recent study emphasizes the hypothesis that premarital intercourse will, as a rule, be unreported (Locke, 1951).

College Graduates Stay Married

Havemann and West, 1952



Economic factors. Marriages are more likely to succeed when the husband and wife are of similar social status and when the couple tends to move upward rather than downward on the social scale (Roth and Peck, 1951). Adequate income, savings, low indebtedness, and steady employment are also positively related to marital success (Williamson, 1952).

The Goode study of 425 divorced mothers indicated that, on the average, upper-income marriages lasted 10.1 years; middle-income, 9.2 years; and lower-income, 8.9 years. When asked the real cause of their divorces, 21 per cent of the women gave an economic reason, such as nonsupport or bad management. Only 49 per cent of the husbands had steady jobs and 64 per cent of them earned less than sixty dollars a week (Goode, 1956).

Although divorces occur more frequently at the lower occupational levels, desertion is almost as common among the higher brackets as among the lower. This was brought out in a study in which 43.6 per cent of desertions in the white population occurred in the upper half of the occupational ladder (Kephart, 1955).

The desire for children. The desire for children seems to be positively correlated with happiness in marriage, but the presence or absence of children does not (Locke, 1951).

Interests. Although it is popularly believed that a married couple should share many interests, studies show that the number of common interests is not important. The type of interest is what matters. The wife need care nothing for poker or boxing matches, and the husband need have no interest in cooking or interior decoration. In fact, one study found that the sharing of such *individualistic* interests was actually unfavorably related to marital happiness (Benson, 1955). Happiness is positively related, however, to the sharing of *familistic* interests—interest in the home itself, the children, demonstrations of love, and religion (Benson, 1952, 1955; Frumkin, 1954).

Personality patterns. As might be expected, emotional stability is very important to success in marriage. The emotional stability of one marriage partner has been shown to be significantly correlated with the happiness of the other partner (Terman *et al.*, 1938). However, the pattern of the personalities involved is also important. We have all known well-adjusted individuals whose personalities

clashed if they were together very long. But when one person's personality needs complement those of the other, such clashes are largely avoided. In marriage most individuals tend to select partners whose needs or personalities complement their own (Winch, 1955; Ktsanes, 1955). For example, a person who needs to dominate others will be attracted to a partner with a strong tendency to depend upon someone else, and vice versa. The selection process is more complicated than a simple attraction of opposites, however, for husband and wife will differ in the intensity of their needs.

Apparently it is not even necessary for couples to understand each other's personalities in order to be happy.

In one experiment couples were asked to state their perception of themselves and of their mates and to predict how the mate would describe himself and his partner. All conclusions were checked against results obtained from random samples of nonmarried couples as a control. (Controls had not been employed in previous studies.) Happy couples showed no better ability to predict how their mates would answer than did the controls. An interesting side finding was that happiness was greater when husbands tended to conform to a stereotyped concept of what a husband should be. This was not important in the case of wives (Corsini, 1956).

The importance of a cooperative attitude. Marriages sometimes appear to be wrecked by trivialities—different preferences in room temperature, disagreement as to whether bridge is more important than a basketball game, failure to agree on who shall keep the household books, different views on credit buying, differences regarding pets. Usually, however, these disputes are merely symptomatic of a more basic difficulty—the failure of the two partners to develop a cooperative attitude. The particular incident cited as the cause of the final break is merely “the straw that broke the camel's back.” Marriage, like friendship, is a give-and-take arrangement in which each participant must be willing to do part of the giving.

Various studies have shown that marriage is happiest when the partnership is a democratic one, with husband and wife playing approximately equal roles. When the wife is definitely dominant, trouble is almost inevitable in the spheres of social and sexual ad-

justment. To a lesser extent this is also true when the husband is extremely dominant over the wife (Maslow, 1942; Tai, 1952). It is apparently important, too, how well the partners agree as to whether equality should prevail.

When randomly selected married and divorced couples were given a scale measuring their attitudes on the question of whether the husband should dominate or the woman should share equally in decisions, divorced couples differed significantly more in their attitudes than did married couples. Divorced females showed the strongest belief in equality of wives, followed by married females, married males, and divorced males, who believed most in male dominance (Jacobson, 1952).

When both partners seek to cooperate rather than to dominate, they may achieve happiness even under unfavorable conditions. This was the case with one couple who had to live with the wife's mother.

When interviewed, the husband explained that he and his wife never "poked their noses" into the mother-in-law's business; and fortunately, she, too, was willing to let the couple lead their own lives. He further stated, "I think that a dominating person is about the worst person to be around. But neither of us tries to dominate the other. I have a horse and sometimes after getting through work I go out to my horse. She does not enjoy such things, but she appreciates my interest. I do the same with the things which she enjoys. I think of my days as my own but the evenings I spend with her, if she has nothing else to do" (Locke and Sabagh, 1957).

Research has shown also that marital compatibility is accompanied by belief on the part of both the husband and the wife that the other spouse is somewhat superior. Each party to a successful marriage tends to assume an attitude of humbleness in relation to the partner. This factor is more important for wives than for husbands. The wife in a successful marriage tends to look to the husband for leadership more often than the husband looks to the wife (Kelly, 1941).

PREDICTING COMPATIBILITY IN MARRIAGE

The investigations described above suggest that it may eventually be possible to build

tests that will predict success in marriage with considerable accuracy. Steps have been already taken in this direction.

A study of three hundred newly engaged couples employed personal interviews and a variety of psychological tests, including the same items of personality, biographical, and social background. Of particular interest is the follow-up study of eighty-two couples two years after marriage. It was found that marital happiness, as predicted from test items answered before marriage, correlated with marital happiness, as measured two years later, at .50 for husbands and .56 for wives (Kelly, 1939).

A scale has been constructed from which marital adjustment can be predicted from adjustment during the period of engagement. A questionnaire on engagement adjustment was given to 505 couples who had known each other an average of 45 months and had an average engagement period of 13.2 months. They all lived in the Chicago metropolitan area and were practically all between the ages of twenty and thirty. About three fourths of the men and two thirds of the women had reached the college level in education.

After three years of marriage the couples were again asked to answer the questions. It was found that the correlation between the adjustment score received before marriage and the adjustment score received after three years of marriage was .43 for the men and .41 for the women (Burgess and Wallin, 1944).

In the 1940's a marital happiness test and a marital aptitude (prediction) test were administered to more than six hundred of the gifted children studied by Terman (page 94) and to their wives or husbands. The median age of the subjects at that time was 26.2 years for the husbands and 23.8 years for the wives. During the period of eight years following, 52 couples were divorced and 591 were not. The correlation between the combined scores on the two tests and marriage vs. divorce was .35 for the husbands and .52 for the wives (Terman and Wallin, 1949).

Locke's comprehensive study of marital adjustment, already referred to several times in this chapter, has clarified a number of the most important factors in predicting marital adjustment. In an attempt to see whether these same factors were predictive in Sweden, Locke gave his Marriage and Divorce Questionnaire to a large number of Swedish couples.

The results of this study indicate that the factors making for success in marriage in one country are not entirely the same as those in another country. Length of courtship, equality in making decisions, shared attitudes toward activities, and many other factors were significant in both localities. Having a happy childhood and happily married parents were even more significant in Sweden than in the United States. Conventionality, as measured by the age when Sunday School attendance was stopped and by frequency of church attendance, was significant in this country but not in Sweden. While both being affectionate and demonstrating affection were important to the success of marriage in the United States, demonstration was frowned upon in Sweden—although the presence of genuine affection was expected. In Sweden more men and women reported premarital intercourse, as might be expected, since the Swedish people have a more permissive attitude toward this practice (Locke and Karlsson, 1952).

These studies all agree that some measure of prediction of adjustment in marriage is possible on the basis of information available about the individual prior to marriage. In general, however, the accuracy of prediction is less than that expected of a good employee selection test battery (Chapter 17). Marital adjustment depends upon no single factor; it results from the successful interaction of the total personalities of the partners. These studies also show that happiness during the engagement period goes with happiness in marriage. Couples who are unhappy in engagement, therefore, should not look upon marriage as a cure for their conflicts.

PROBLEMS

OF ILLEGAL BEHAVIOR

"Our youth now love luxury. They have bad manners, contempt for authority. They show disrespect for elders and love chatter in place of exercise. Children are now tyrants, not the servants of their households. They no longer rise when elders enter the room. They contradict their parents, chatter before company, gobble up their food and tyrannize their teachers." These are not the words of some harassed modern parent, but were spoken by Socrates as long ago as the fifth century B.C.

Juvenile misbehavior is not strictly a modern phenomenon. Recent increases in both the prevalence and seriousness of delinquent behavior, however, make it a particularly pressing social problem today. The number of juvenile court cases involving children under the age of seventeen in the United States increased by 85 per cent from 1940 to 1953, while the number of children under seventeen in the population actually declined 1 per cent. The increase in number of court cases is partially due to more effective law enforcement; but just how much influence this factor has had, nobody knows.

Delinquency is defined as legally prohibited behavior committed by minors. Similar behavior on the part of adults is labeled as *crime*. Illegal behavior is no small problem in the United States, where two major crimes are committed every minute. The annual cost of law enforcement is about four billion dollars. Obviously the problem of reducing our crime rate is one that deserves serious study.

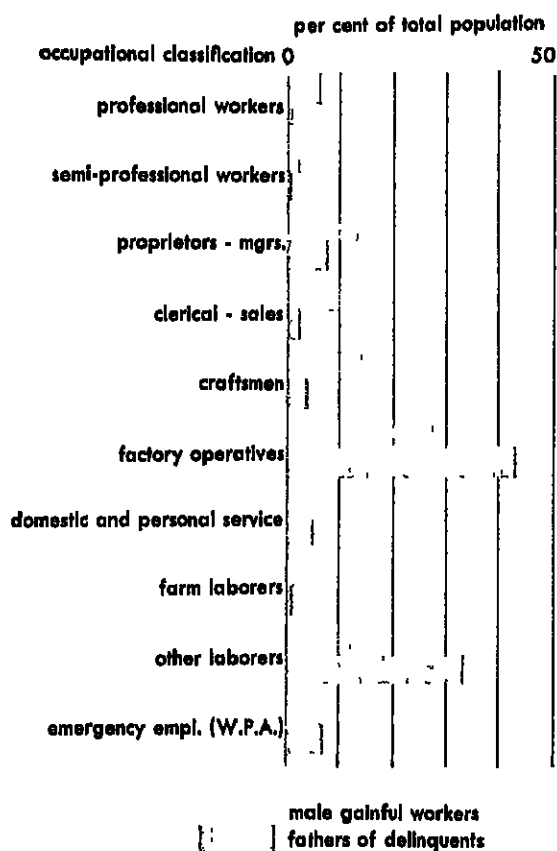
CAUSES OF ILLEGAL BEHAVIOR

People behave in ways that give them the greatest apparent rewards. If many of a young person's needs seem to be met by delinquent behavior and to be frustrated by socially acceptable behavior, he will probably become delinquent. The child or adolescent who has once adopted delinquent behavior gradually loses the possibility of earning rewards by other means. He associates with other delinquents; he accepts their heroes and values; and as time goes on, it becomes increasingly difficult to inspire him to seek conventional social approval. He now belongs to a selective social group whose ideals and laws are different from those of society as a whole. His loyalty is to this smaller group, and his first interest is to win and maintain its approval.

What factors of environment or heredity cause an individual to adopt illegal behavior in the first place?

Poverty. It is probable that much delinquency has its roots in the material frustrations that occur in lower-income groups. Youth may be driven to illegal behavior in the search for the necessities of life, as well as for some of its comforts and pleasures. That poverty is often a factor contributing to juvenile delinquency has been shown by many studies.

Occupations of Parents of Delinquents



One investigator compared the occupational distribution of parents of 761 delinquents in Passaic, New Jersey, and the distribution of all male and female workers in the community in 1940. This comparison is illustrated in the above chart. In the delinquent sample, significantly fewer parents were in the professions or working as proprietors, clerks, sales personnel, craftsmen, or in nondomestic service. Significantly larger proportions were factory operatives, laborers, and domestic servants (Kvaraceus, 1945).

A more recent study, made in a small city (Boulder, Colorado) rather than a large metropolitan center, dealt with the relation of housing to delinquency. Children who lived in inferior houses tended to become delinquent in much greater numbers than did children living in attractive homes (Barker, 1954).

One investigator has made a number of studies to determine what causes certain juvenile offenders to get into trouble repeatedly, whereas others have only one offense. Here again poor socio-economic conditions

were shown to be a significant factor, especially for repeaters in the adolescent age group (Wattenberg, 1949, 1954).

The influence of transitional areas. A sociological study has clearly shown that delinquency is highest in areas that are in a process of transition from residence to business and industry. These high-delinquency transitional areas are characterized by physical deterioration and poverty. The population is decreasing and neighborhood culture and organization are breaking up. Consequently, the group code of behavior is not well established, and there is less social pressure on the individual to conform to legal standards. This study (Shaw *et al.*, 1929) and later ones by the same workers have been summarized as follows:

"In a careful survey of juvenile delinquency in Chicago among boys from 11 to 17 years of age, it was found that the city could be divided into a number of zones or delinquency areas, starting with the central or Loop district and progressing to the residential suburbs. In all, seven such zones were mapped at one-mile intervals from the center. It was found that there was a progressive decrease in the proportion of delinquency from the center to the periphery of the city. The study extended over a considerable period of years during which the population of the central area changed completely without affecting this relationship. There were, for example, successive waves of migration from various European countries, as well as of Mexicans and Negroes, but the delinquency rate remained substantially the same. This has usually been interpreted as meaning that the social and economic setting, rather than the nature of the people concerned, has a definitive influence upon the delinquency rate" (Klineberg, 1940).

Family breakdown. A thorough study in the state of Connecticut found delinquency to be essentially a symptom of family breakdown. When the family disintegrates, the child may be deprived of affection, feelings of security, social opportunities, and physical necessities (Robinson, 1947). If a delinquent gang can satisfy some or all of these needs, the child may come to rely on it and, in turn, to give it his primary loyalty.

Although lack of family protection was found in the Connecticut study to be at the root of most juvenile delinquency, in a very few cases the children had been overprotected in their upbringing.

The psychological effects that "broken homes" sometimes have on children—whether the homes are broken through emotional tension, death, or divorce—are apparent in many case studies of juvenile delinquents. And we cannot discount the fact that a very large proportion of delinquents come from broken homes. But to what extent does family breakdown, in and of itself, contribute to delinquency? There is recent evidence that its importance has been somewhat overemphasized. In Detroit in 1953, for example, 81 per cent of the delinquents came from families in which there were no quarrels, and 94 per cent reported that they liked their homes. Furthermore, when delinquents have been paired with matched control groups, the factor of a broken home has seemed to lose some of its significance (Smith, 1955).

In a recent British study, children from broken homes were found to exhibit no more signs of emotional disturbance than those from unbroken homes.

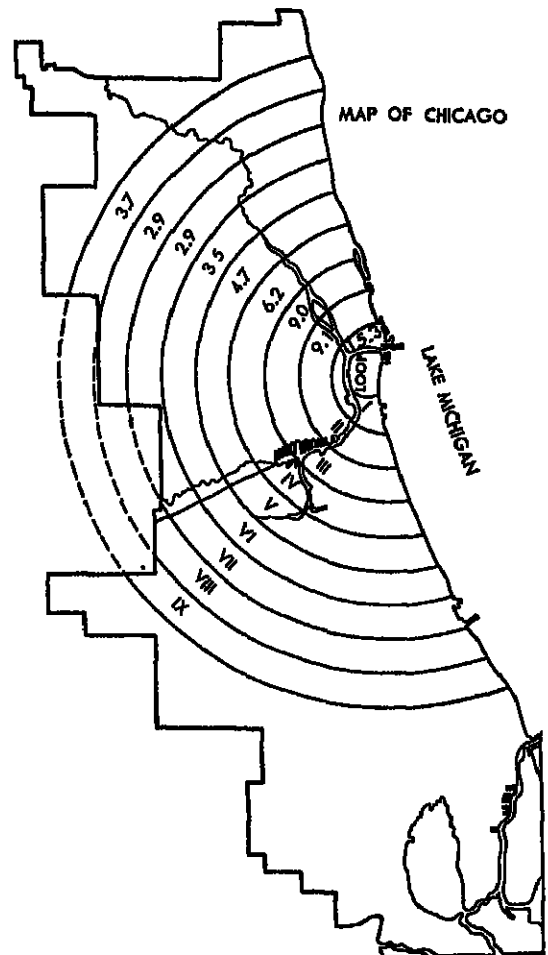
The study covered a total of 5000 children randomly selected from all children born in England during the week of March 3 to 9, 1946. The plan was to obtain follow-up data on these youngsters at two-year intervals. By 1950, 67 children had lost either a mother or a father by death, 42 had divorced parents, 69 had separated parents, and 111 had parents who were temporarily separated because of illness or work requirements. In the study these were paired with a control group, similar in sex, order of birth, economic status, etc., whose parents were living together. Only legitimate children living with the mother were studied, since the vast majority of children of broken homes fall into this category. At the age of four the children from broken homes showed no more emotional disturbance, as evidenced in eating difficulties, thumb sucking, nail biting, or night terrors than did the controls. However, they did show significantly more bed wetting. By the age of six this difference was no longer apparent (Rowntree, 1955).

The children studied were still too young to be delinquents, of course, and later follow-ups may reveal greater differences between the two groups. But thus far the results seem to indicate that living in a broken home need not in itself be a factor in emotional disturbances.

It is difficult to determine the complex relationship of home conditions to delinquency. One problem is that economic factors are so closely related to broken homes that it is

almost impossible to separate them for study. Also, the higher rates of delinquency for children from broken homes, as measured by juvenile court cases, are partly due to differential treatment. For example, a child picked up for stealing is likely to be let off with a warning if he has a father who is willing to make restitution of stolen property.

Emotional maladjustment. Numerous studies indicate that delinquency often has its roots in emotional factors unrelated to poverty or physical surroundings.



This map of Chicago shows how the rate of delinquency varies with the section of the city. Note that central zones I, II, and III, which are transitional areas, have the highest delinquency rates and that the rates grow progressively less toward the residential suburbs. The delinquency rate is the ratio of the number of male delinquents, ages ten to sixteen, appearing in Chicago's Juvenile Court from 1917-1923 to the total population in 1920 (Shaw, 1929).



Transitional areas offer youngsters few opportunities or facilities for healthy recreation. In such a setting, a boy may turn to illegal behavior in his search for excitement and recognition.

One clinical study was made of 105 delinquent children brought into the child guidance clinics of Boston, New Haven, and Detroit during a four-year period. Each delinquent child was compared with one of his own nondelinquent siblings, so that socioeconomic environment could be held fairly constant. The results showed that serious emotional difficulties were experienced by about 91 per cent of the delinquents but by only 13 per cent of the nondelinquents and that within this category lay the greatest differences between the scores of the two groups. The psychological stresses most clearly evidenced by the delinquents were rejection, insecurity, guilt, inferiority, jealousy, and internal mental conflict (Healy and Bronner, 1936).

Some interesting findings on the emotional and perceptual characteristics of delinquents have come out of a recent study aimed at developing tests that would identify potential delinquents before they got into trouble. The investigators compared nondelinquent boys with "psychopathic" delinquents—boys who had been in serious trouble more than twice for offenses gratifying immediate needs rather than resulting from group pressure or neurotic tendencies (Sarbin and Jones, 1955).

In one of the tests given to these two groups, the subject sat behind a table with a gunlike mechanism



and a push button before him. He faced a screen upon which were shown a "friendly" and an "enemy" plane, and the identifying marks of each were pointed out. He was then shown a series of twenty-five pictures of planes and asked to fire the gun mechanism at enemy planes and to push the button to "clear" friendly planes. Among the pictures were six planes with no identifying marks. Afterward, the subject was asked what he did in response to these ambiguous planes.

Delinquents were significantly slower and less accurate on the initial trials of designated planes, indicating that discriminations are difficult for them. Although they showed less delay in responding to unmarked planes—indicating a high level of impulsiveness—they did not "fire" at significantly more ambiguous planes than did the controls. However, when asked how they had responded, they stated more often than the controls that they had fired. This supported the investigators' hypothesis that delinquents' evaluation of their own past performance is less accurate than is the evaluation of past performance by nondelinquents.

Under conditions of tension, delinquents tended to perform poorly, defying instructions and making unfavorable comments more often than the controls. When asked to copy geometric figures, delinquents did so more rapidly but less accurately than the controls. Under restricted conditions, when asked to copy the figures within small printed boundaries, the

delinquents speeded up all the more, whereas the controls did not. In a test in which they were asked to complete incomplete figures, the delinquents were significantly less successful than the controls (Jones, Livson, and Sarbin, 1955).

Intelligence. There is a widespread belief among laymen that crime and low intelligence go together. Has this belief been given any support by psychologists?

One psychologist brought together the estimates of a number of authorities as to the proportion of delinquent children who are feeble-minded (Pintner, 1923). The figures ran from 7 to 93 per cent. This lack of agreement among experts has two major explanations. First, in certain communities the children of the better families never get before the juvenile court. The parents are well known and are trusted to handle their delinquent children in their own way. Under such circumstances only the children of poor and uninfluential families, who tend to score lower on intelligence tests, would get before the court. The second factor accounting for the wide range of findings is the range of efficiency of law enforcement. Where enforcement is strict and fair, the bright and the dull alike will be apprehended. Where enforcement is lax, the brighter children will "get away with it" more often.

In general the conclusion seems to be that intelligence has little influence on whether or not an individual becomes a delinquent or a criminal but that it may partially determine the type of crime he will commit and, depending upon enforcement procedures, whether he will be caught and convicted.

One recent investigation has thrown new light on this question. Instead of total I.Q. scores, as in most studies, the scores of delinquents and nondelinquents were compared on certain subtests of the Wechsler-Bellevue Intelligence Scale. The delinquents made poorer scores on the Digit Symbol test, which requires sustained effort, and on the Information subtest; and in a number of replies on the Comprehension test they indicated that, while aware of socially accepted standards, they were not always willing or able to apply them in their own behavior (Vane and Eisen, 1954).

Further research is needed to determine the relation of the various factors of intelligence to delinquency. A review of the literature

suggests that, at the most, intelligence can be considered as only one of many factors influencing criminality. Poverty, broken homes, bad companions, and frustration seem far more important than low intelligence. Fortunately these factors can be counteracted by measures aimed at improving the environment—planning for better schools, supervised play, family counseling, or improved economic conditions. Were native intelligence the fundamental factor in delinquency, the outlook for improvement would be much less hopeful.

The effect of movies, television, and comics. Many studies have been made to determine the effect that attending movies, watching television, and reading "horror" comic books may have in encouraging delinquency. In 1954 the fourth annual study of the National Association for Better Radio and Television revealed that production of crime programs for children had increased four times in as many years (*Film World*, 1954). In a study of comics one investigator found, in only five comic books purchased one day in 1954, a wide variety of horrors that included molten metal being poured down a man's throat, a girl's boy friend suddenly turning into a monster and killing her and seven other girls, a snake crushing a man, a girl torn to pieces by a gorilla, a partially decayed corpse floating on a pond, and claw-fingered sea goblins carrying off a number of women to make them their wives (Blanshard, 1955).

The National Council of Juvenile Court Judges has stated that the comics should be called "tragedies" because of their bad effects on children and the delinquency they help to cause. Others have also expressed concern over the possible effects on children of horror and crime stories—whether in comic books, television, or the movies. Some psychologists believe, however, that crime stories act as a sort of safety valve by providing children with an opportunity to express hostility vicariously.

THE PREDICTION OF ILLEGAL BEHAVIOR

In the case of criminal and delinquent behavior, as in other aspects of human adjustment, the true measure of our understanding is our ability to predict future behavior. Many so-called "predictive tables" of factors in de-

linquency have been prepared, but few have passed the "acid test." When well-controlled attempts have been made to predict parole violation or criminal and delinquent behavior, the results have usually been disappointing (Ohlin and Duncan, 1949; Schuessler and Cresssey, 1950).

A recent study indicates, however, that psychologists may at long last be on the right track. Two investigators, Gough and Peterson, have built a series of predictive test items around the central theory that the delinquent individual is unable to look upon himself as a social object and hence to set up a series of expectancies and critiques. In other words, the delinquent cannot see himself as others see him; he cannot evaluate his behavior in terms of its consequences in the lives of others and on their welfare. He has been called "morally blind," a "social imbecile," and other names descriptive of an immature, self-seeking individual.

A few of the test items developed by these workers, along with the answers they consider as predictive of delinquency, follow:

- I think Lincoln was greater than Washington. (F)
- If the pay was right I would like to travel with a circus or carnival. (T)
- Life usually hands me a pretty raw deal. (T)
- My parents never really understood me. (T)
- It is very important to me to have enough friends and social life. (F)
- My home life was always happy. (F)
- Before I do something I try to consider how my friends will react to it. (F)
- I find it easy to "drop" or "break with" a friend. (T)
- I often think about how I look and what impression I am making on others. (F)
- It is hard for me to act natural when I am with new people. (F)
- When I was going to school I played hooky quite often. (T)

A scale made up of forty-two such items was administered to 1092 incoming recruits at Fort Ord, California, and to 99 stockade prisoners at the same post. It was found that 52 per cent of the Army prisoners scored twenty or higher as against only 9 per cent of the incoming recruits. Likewise, a study of prisoners at the Lackland Air Force Base in Texas showed that a fifty-eight-item version of the test differentiated between first offenders and repeaters in a group of 353 stockade prisoners, of whom 209

were first offenders and 144 were repeaters (Gough and Peterson, 1952).

Further validation studies of the test conducted on a wide variety of persons, from high school "best citizens" through "disciplinary problems" to prison inmates, have given still more support to the authors' theory (Gough, 1954).

Many "delinquents" have one brush with the law and then get into no further trouble. It seems particularly important, therefore, to discover what factors are operating in the lives of offenders who repeatedly violate the rules of society. Although most investigations of delinquency have made no attempt to distinguish between first offenders and repeaters, one recent series of studies by Wattenberg and others has done so.

One of these studies dealt with the 207 ten-year-old boys who had been the subjects of complaints to the Detroit police in 1948. Only forty-three got into trouble again during 1950, supporting the hypothesis that much pre-adolescent delinquency occurs among normal children passing through a difficult stage of development. Significant factors distinguishing repeaters included living in apartments or rooming houses, having two or more brothers, failing in school, or being members of classes for the mentally retarded (Wattenberg and Quiroz, 1953). Poor school work and low intellectual ability showed up even more strongly in a later study of eleven-year-old offenders, and in both studies a reputation for mischief—membership in the "Peck's bad boy" category—was highly significant (Wattenberg, 1954).

In the same group of investigations, a study of girl offenders revealed that the range of factors discriminating between repeaters and nonrepeaters was narrower. Girls had more conflict in their homes, especially with their mothers, and were more often charged with offenses connected with the home. Economic conditions seemed less significant (Wattenberg and Saunders, 1955). The whole problem of predicting criminal behavior—and, particularly, of distinguishing repeaters from nonrepeaters—has tremendous social importance. Much additional research is needed in this important field, where attempts to predict have not yet been as successful as they have in such areas as marital adjustment or vocational adjustment.

THE PSYCHOLOGICAL BASIS OF CRIME PREVENTION

Criminologists have come more and more to believe that an adult who is a habitual criminal is almost hopeless of rehabilitation. Students of delinquency and crime are agreed that prevention should start early if it is to be effective. Determining the conditions that cause delinquency and nonconforming behavior is merely the first step. The next step is trying to correct those conditions. The two most important avenues to crime prevention are community action and judicial action.

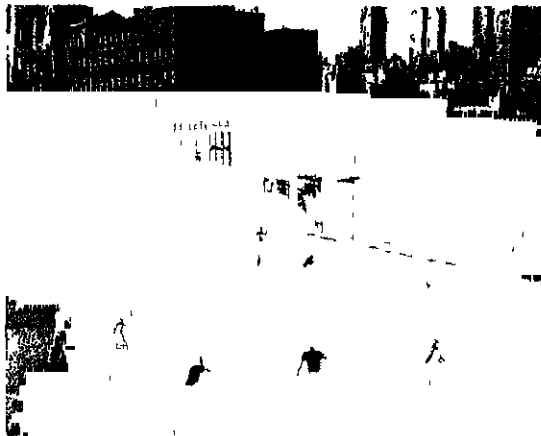
Community action. Many social institutions can help check delinquency in its early stages. Such organizations as the Girl Scouts, the Boy Scouts, the Y.M.C.A., and various church organizations can direct the gang spirit into useful activities. Slum clearance projects typically provide for playgrounds with adequate equipment and competent supervision. Children who find interesting play in the open are not likely to resort to hideaways in vacant tenement buildings or abandoned stores or factories, as many slum-dwelling children are forced to do.

Professional social workers are also doing a great deal to combat delinquency. Trained to recognize the first symptoms of trouble,

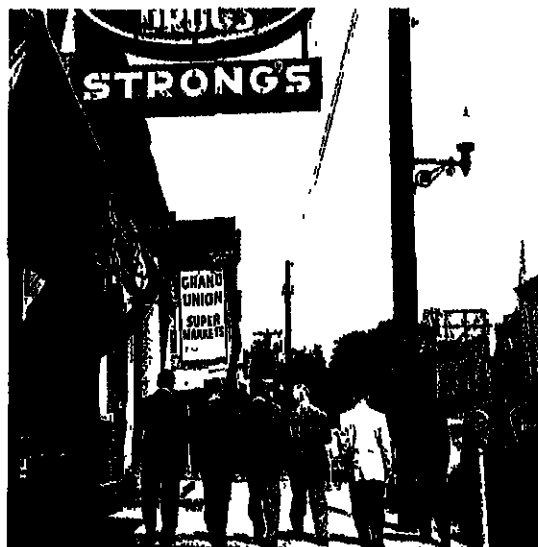
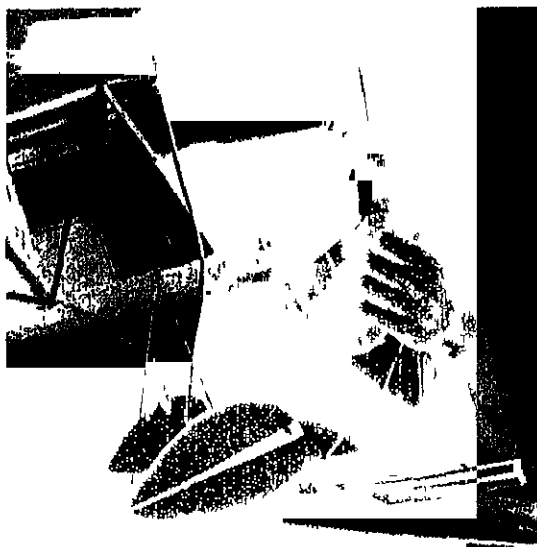
they often are able to correct the sources of a child's difficulty before he becomes seriously delinquent.

An outstanding example of how social-psychological studies may be translated into effective action is the Chicago Area Project. This Project was organized years ago by social scientists at the Illinois State Department of Public Welfare (including Clifford R. Shaw, some of whose research was described on page 406). It operates on the basic assumption that the local neighborhood can be organized to deal effectively with its own problems. The founders of the Project did not simply send in social workers and group leaders foreign to the community; they stimulated the local residents to become aware of the problem of delinquency and to take collective action. They guided the local leaders and local organizations in establishing such activities as camping, baseball, football, basketball, boxing, movies, ping-pong, pool and billiards, music, dramatics, handicrafts, printing, newspaper work, and club discussions.

The activities of the Chicago Area Project have been concentrated in those areas where delinquency rates have been very high, and the results have been most gratifying. In at least one area juvenile delinquency rates have shown a marked decline. Equally important



Different communities have tried to prevent juvenile misbehavior in various ways. In addition to setting up recreational centers for youngsters, some cities utilize roof tops for play areas or rope off certain streets for games. If a young person gets into trouble with the law, some communities also provide him with special help. In Chicago, for example, the Back of the Yards Council has committees made up of neighborhood adults such as the district captain of police, a clergyman, a school principal, a probation officer, a labor union representative, and others who will talk things over with the boy or girl in order to get at the root of the difficulty and work out a solution.



Correctional institutions for juvenile delinquents are too often places for punishment rather than for rehabilitation. This is not true at the Annex of State Training Schools for Boys, New Hampton, New York. Here treatment is organized around the belief that delinquents are boys with problems. Hence they receive fairly intensive psychotherapy to help them gain a better understanding of themselves. While at the Annex, each boy is trained to handle a job when he returns home. A sports and recreation program operates at all times, and many boys take advantage of the opportunity to learn a hobby. They are given maximum freedom, best manifested by the off-grounds trips they may take, after eight months at the Annex, to see a movie or ball game or to visit a staff member and his family. The staff members try to consider each individual's problems and progress, so that, probably for the first time, the boys discover there are adults who care for them as persons and really wish to help them.

is the example set by the Project in attacking delinquency as a community problem.

Judicial action. In all too many cases the treatment of juvenile delinquency is delayed

until judicial action is necessary. But even then the hope of rehabilitation is not lost. The modern juvenile court authority tries to become an expert in human relations. He

studies the offender as well as the offense and then tries to impose whatever treatment will, in his opinion, be most effective in preventing a recurrence of delinquency. Unfortunately a judge is frequently handicapped by outmoded legal concepts which are inadequate for meeting many of the problems that changing times have brought to our courts. Some improvements have been made, and others are in the offing. The practices of probation and parole, the differentiation between juvenile delinquents and adult criminals, the emphasis on rehabilitation rather than punishment are all to the good. Outmoded laws and inadequate facilities, however, still interfere with the most effective handling of many cases that are brought to court.

Some recent recommendations for dealing with delinquents have been made by a committee of the New York School of Social Work. They have been summarized in the form of nine specific proposals (Klein, 1945).

Proposal 1. Separate the judicial and the penal functions. The power of the courts should be limited to the determination of guilt or innocence. Then the delinquent should be handed over to psychologists and social welfare workers who are trained to handle his custody, education, rehabilitation, and eventual release.

Proposal 2. Provide adequate personnel. Many more social workers, psychologists, psychiatrists, and vocational guidance experts are needed to change the lawbreaker into a law-abiding citizen.

Proposal 3. Refrain from treating delinquent children as lawbreakers. Rehabilitation seems much more effective than punishment in curing delinquent children.

Two separate studies have indicated that when juvenile delinquents are institutionalized for punishment, they are not "cured" of aggressiveness (Healy and Bronner, 1926; Bowler and Bloodgood, 1936). In fact, one study has demonstrated that severe punishments tend to increase rather than decrease the crime rate (Wilson, 1931).

Proposal 4. Give public authority exclusive control. This proposal urges that the practice of assigning adjudged delinquents to private associations or denominational bodies through court commitment should cease.

Proposal 5. Let the system that is set up embrace all parts of the country and all kinds

of people. Delinquency is not limited by place, color, or creed, nor can its treatment be thus restricted.

Proposal 6. Improve reform practices within correctional institutions. Prisons and reformatories are still too often places where adults and children are broken in mind and body by cruelty, neglect, and plain ignorance on the part of inadequately trained and underpaid personnel.

Proposal 7. Improve the caliber of judicial practice. Most juvenile delinquents first appear in the lower courts and are handled there. Wisdom and experience in human relations are greatly needed by the judges of the lower courts but are frequently lacking because of poor pay, low prestige, and generally poor organization.

Proposal 8. Improve police practice. A police officer—if properly selected, trained, and assigned—will become respected by the parents and children of the community. Thus he will be able to detect and prevent much crime and delinquency in the incubation period.

Proposal 9. Dissolve artificial classifications of criminals. They should be replaced by a legally established concept of "persons having demonstrated behavior injurious to the social order" and needing psychological and social rehabilitation.

All these proposals are based on a recognition of the social and emotional roots of illegal behavior. Juvenile delinquents and adult criminals are not born but made—by their childhood experiences in the home and in the community.

PROBLEMS

OF PREJUDICE

The United States has traditionally prided itself upon being a "melting pot" of various national and racial groups, a country where religious and political freedom are guaranteed and class distinctions are discouraged. But there can be no constitutional provision against prejudice, and in all areas of life we find that certain individuals and groups are denied a portion of their freedom. In spite of legislation to prevent discrimination, job opportunities

are sometimes closed to certain groups. We find housing areas, restaurants, hotels, resorts, and schools that are "restricted" to white people, to Gentiles, or to others. Children and adults alike are excluded from certain activities because they are Negro or white, Jewish or Christian, Catholic or Protestant, upper or lower class.

Our person-to-person relationships are constantly influenced by our feeling that members of groups to which we do not belong are somehow "different" from—and therefore inferior to—ourselves. It has been estimated that four fifths of the American population "harbors enough antagonism toward minority groups to influence their daily conduct" (Allport, 1954).

The consequences of such antagonisms are far-reaching. We hear a great deal about minority groups being denied social, economic, and educational opportunities, but sometimes we tend to overlook the "minor" everyday frustrations that any victim of prejudice inevitably suffers. We sometimes forget, too, that the community is affected not only by outbreaks of actual violence but by denying itself the talents and support of minority groups. Organized Communism uses our history of color prejudice as a powerful psychological weapon against democracy and at the same time has made a deliberate effort to stir up racial antagonism within the United States.

Because racial antagonism has been the most serious area of prejudice in our country, we shall spend a large part of this section examining its causes and cures. But it is important to remember that this is only one of many areas of prejudice affecting us as individuals and as members of various groups. Very few of us are free from prejudices of one sort or another. If you are free from color prejudices, for example, perhaps without realizing it you are prejudiced against people who *do* have racial antagonisms. Before we can try to cure a prejudice, we must try to understand its causes. In the case of racial prejudice, we should begin by examining the real and alleged differences between racial groups.

WHAT IS A RACE?

Geneticists believe that mankind was once a homogeneous group, with common genetic

materials and common physical characteristics. They believe that, as various groups migrated and became geographically isolated from the original ancestral group, two processes worked to produce physical differences between one subgroup and another. The physical characteristics of present-day races—differences in skin color, hair texture, and the like—can be explained first of all by *the inherent variability of genetic materials*. Random variations in genes occur spontaneously but slowly, so that originally homogeneous groups come to exhibit certain differences. The second process for explaining the differentiation of races is *gene mutation*. Very frequently, in all forms of life, a particular gene will undergo a sudden change in its chemical structure which is expressed in the appearance of a new trait. Thus variations in eye color or hair texture may arise spontaneously through mutation.

Once primary biological differences appeared in human subgroups, they were preserved by many generations of inbreeding. Such inbreeding was encouraged by geographic boundaries between groups, social restrictions on marriages between members of different groups, and learned individual preferences in mating, such as resemblance of a spouse to a parent.

Human variability is a natural process and one that is going on all the time. Thus any scheme for classifying races can have validity for only a brief length of time. The natural process of biological change does not slow up because some man-made system for naming races has just been devised. Therefore, each system is a little outdated as soon as it is published.

Physical differences among races. Physical differences have been the basis of a classification which divides the human group into three subdivisions: the Mongoloid or "yellow race," the Negroid or "black race," and the Caucasian or "white race." The differences upon which these classifications are based include the following: skin color, cephalic index (the ratio of skull breadth to skull length), eye form and color, hair color and texture, stature, nose shape, and "blood."

Close examination of these characteristics reveals, however, that they are scarcely reliable indices of racial "differences." Skin color, for example, is determined by the relative quantities of two pigments which are

identical in all races, and color varies a great deal within each racial group. Classifications of "long-headed" or "broad-headed" also fail to cover many individuals in any group, and whole groups may change their characteristic head shape as a result of changes in diet or climatic conditions (Guthe, 1918; Boas, 1932). Changes in environment also affect stature, which again varies so much from individual to individual that there is much overlapping among racial groups. The fold of skin responsible for the slanted appearance of Mongoloid eyes is also characteristic of many Ethiopians and American Indians. It is even found sometimes in white infants, although it does not persist into adulthood. Hair texture and nose shape also vary too much to be hard and fast indicators of racial membership. Finally, all four blood types—A, B, AB, and O—are found in all major races, and blood of a given type can be freely interchanged in transfusions regardless of whether the donor is Caucasian, Negroid, or Mongoloid.

A persistent popular notion is that different racial groups are characterized by distinctive odors, but evidence against this was obtained in a recent study in which two Negro and two white college boys volunteered as subjects.

All four boys showered with Ivory soap, donned identical gym clothes furnished by the school, and exercised vigorously for fifteen minutes so that they would perspire freely. When the subjects were draped in clean sheets so that they were hidden from view, fifty-nine other students who acted as judges were unable to tell the Negroes from the whites on the basis of body odor either before or after they had exercised (Morlan, 1950).

Psychological differences among races. Some racial theorists have maintained that the physical characteristics which are supposed to differentiate races are simply external signs of internal "psychological" traits. It has been shown that there is no connection between bodily traits and psychological traits (Hogben, 1932), but this fact in itself does not prove that there are no inherited psychological differences among racial groups. We must examine the evidence in more detail.

Sensory differences. It has long been popularly believed that primitive men have keener senses than their civilized relatives. However,



These sculptures illustrate the difficulty of setting up rigid race classifications; the "distinguishing" features of the different races are shown to merge into each other almost imperceptibly. For example, head 1 is a Javanese boy whose features are primarily "Mongoloid," while head 2, an African bushman woman, has features so mixed that it is almost impossible to tell if she is Mongoloid or Negroid. Similarly, head 3 would ordinarily be classified as Negroid, but head 4, a West African, possesses both Negroid and Caucasian characteristics. Head 5 is Caucasian. In the Ainu man, head 6, Mongoloid and Caucasian traits are so intermingled that classification in either group would be purely arbitrary. Perhaps the most striking example of the continuity of races is head 7, a Samoan man, who presents such a mixture of all three "main stocks" (1, 3, and 5) that it is virtually impossible to classify him as a member of any one "race."

this notion is without scientific support. In 1904 a psychologist examined a group of three hundred persons representing such diverse peoples as the Negritos, Eskimos, Ainus, Filipinos, Patagonians, and American Indians, who had been conveniently brought together at the St. Louis World's Fair (Woodworth, 1910). After extensive testing he concluded that sensory acuity differs in degree from individual to individual but is about the same from one group to another. Apparent differences in sensory sensitivity are probably to be explained by the fact that people in certain cultures use their sensory capacities more fully than others (page 261).

Behavioral development. There is no valid evidence for a belief in "white superiority." In studies which report certain races as superior, heredity and environment may both have varied in such a way as to favor one group over another. This vital point is borne out by a study of the development of Negro and white infants, conducted in New Haven, Connecticut. Among other things this investigation demonstrated that the average Negro infant born and raised in New Haven is at first equal in behavioral development to the average white infant. Then in the third half-year a retardation of developmental rate sets in among Negro children that can be explained in terms of cumulative effects of the substandard environment in which many New England Negroes live (Pasamanick, 1946).

Intelligence differences. We have already discussed the problems involved in trying to determine how the average intelligence of one race compares with that of another (pages 105-108). The evidence, though inconclusive, suggests that there are no important differences.

"Races" vs. "ethnic groups." It seems safe to conclude that the characteristics usually regarded as a basis for dividing mankind into different "races" are dubious foundations for racial theory. Such characteristics are products of genes common to all men; they occur to some degree in all human groups; and they are largely quantitative rather than qualitative differences in human structures and functions. Moreover, the personality and character differences among races seem to result from environmental rather than hereditary influences. With the growing similarity of all environments and the intermingling of various groups, it can be anticipated that so-

called racial differences will diminish as time goes on.

Some social scientists have suggested that it might be a good idea to drop the term *race* entirely. Through the widespread use of this illogical term, a great variety of people of differing biological backgrounds are lumped together and treated in essentially the same way. A more accurate term is *ethnic group*, which refers to a group of people who, on the basis of one or two identifying characteristics, are treated socially as though they constitute a special group.

Nationalism as a form of prejudice. Much of what we have said about racial prejudices also holds true of national prejudices. In fact, many people confuse nationality groups with races—they speak of the German race, the Spanish race, the Japanese race, the Jewish race.

Extreme nationalism is a form of prejudice. People identify themselves with the nations of which they are citizens and act as if they *have* more virtues and *should* have more power than any other nation in the world. Each nation tends to exaggerate the differences between itself and other nations in the direction of its own superiority. Because of a widespread tendency for people to distrust and fear the unfamiliar, this emphasis on differences tends to promote international conflict. The absurdity of the extreme nationalist attitude is seen in the fact that, just as there are no "pure" races, so there are no "pure" nations in the cultural sense. The culture of the United States itself is an amalgamation of the culture traits of many different nations and peoples.

ORIGINS OF PREJUDICE

Research has shown that there is little scientific basis for a belief in the innate superiority of any group—racial, national, religious, or other. What, then, are the origins of prejudice? The analysis of this problem may suggest a practical program of action for eliminating prejudice.

Some people have always maintained that certain prejudices, particularly those against people of a different skin color, are instinctive. Enough has been said throughout this book about the way social attitudes are acquired through learning to indicate the falsity of such a hypothesis. If a particular prejudice

were an *inborn* human characteristic, it would be found in all human groups. But in China there is no anti-Semitism, and in South America and parts of Europe there is no widespread feeling against Negroes. Recent manifestations of anti-Semitism in Russia represent political maneuvering and propaganda rather than deep-seated convictions on the part of most people. Nor can these differences in attitude the world over be explained on a "racial" basis, for children of Spanish parentage born and reared in the American South tend to be prejudiced against Negroes, while children of Spanish parentage born and reared in Brazil do not.

Conditioning from isolated experiences. Just as conditioning can operate to make a person fear various objects in his environment, it also operates sometimes to give us prejudiced attitudes. For example, a few frightening or irritating contacts with individual Mexicans or Germans, if they produce a sufficiently strong emotional response, may result in a generalized aggressive feeling toward all Mexicans or Germans. Attitudes learned this way may persist throughout life. The contact does not have to be of a particularly dramatic kind. Contact maintained over a period of time with a foreigner who is not liked *as an individual* may build up a powerful prejudice against foreigners *as a group*.

Exposure to prejudiced attitudes in others. We learn most of our prejudices through association with prejudiced people. Parents are often the first to sow the seeds of prejudice—when they forbid their children to play with those of other ethnic groups or simply make disparaging remarks about them. Teachers, whose influence on a child is usually second only to that of his mother and father, are also potential sources of prejudice. Children frequently vent their aggressions on someone who has previously been singled out by an adult in authority. Any expression of personal bias by a teacher will influence the attitudes of children.

Age-mates, too, are highly influential. In order to be accepted by their "gang," children usually conform to its attitudes. Often they develop prejudices by associating with a group which is aggressive toward certain ethnic groups, which excludes children from minority groups, or which relegates minority group members to menial positions.

Movies, comic strips, books, and occasion-

ally schools and churches contribute to the development of prejudice through the purveying of stereotypes, or set notions, about certain groups of people. Negroes, for example, are generally portrayed on the screen as servants or laborers. When we are prejudiced against a person we *prejudge* him—we think that because we can classify him as a member of a certain group, he must have the pattern of characteristics which, rightly or wrongly, we associate with that group. Thus many people think of the French as immoral, the Italians as excitable and shiftless, the Japanese as treacherous, the Scotch as overly thrifty. Such false stereotypes are perpetuated in jokes, in the words of popular songs, and in the columns of daily newspapers.

Studies of children suggest the manner in which prejudices are learned. They do not yet exist at the nursery school level. As children become slightly older they often imbibe vague sentiments of prejudice from their parents, together with a realization that people are classed into definite groups—though often they have but an ill-defined notion of these groups. One little girl mentioned by Allport, for example, ran home to ask,

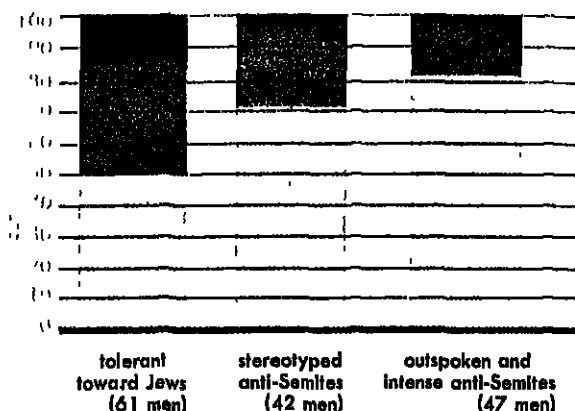


Very young children are usually utterly unconscious of differences of race or nationality. This friendly whispered conference between a Japanese girl and her Mexican friend took place at the United Nations International School, where children from all parts of the world work and play together.

Interrelation Between Anti-Semitic Attitudes and Anti-Negro Attitudes

This graph, showing the interrelation of anti-Semitic and anti-Negro attitudes, is based on the reactions of one hundred fifty veterans from Chicago, Illinois. In the majority of cases, tolerance toward Jews was accompanied with an even more tolerant attitude toward Negroes, and as intolerance toward Jews increased, even greater intolerance toward Negroes was indicated (Bettelheim and Janowitz, 1950).

tolerant toward Negroes
 stereotyped anti-Negro
 outspoken and intensely anti-Negro



"Mother, what is the name of the children I am supposed to hate?" (Allport, 1954).

Prejudice grows steadily with age and is still increasing at the eighth-grade level. When children are about ten or eleven they tend to reject Negroes or other minority groups totally. Gradually, however, they begin to differentiate between the various kinds of people in a particular group, treating some more favorably than others. Or the individual may learn to give lip service to equality but continue to discriminate against certain groups.

As revealed in one nursery school study, Negro children tend to become aware of race earlier than white children, although they may not realize they are Negro themselves. Thus one little Negro girl turned to her white playmate and said, "I'd hate to be colored, wouldn't you?" (Goodman, 1952).

Personality characteristics. A prejudiced attitude toward any group does not depend wholly upon experience with a few members of the group or even upon exposure to the prejudiced attitudes of others. Often a person seems to have a generalized attitude of prejudice against all groups to which he does not belong. If he is prejudiced against Negroes, he will also tend to be prejudiced toward a number of other minority groups. An ingenious study of college students' attitudes revealed this tendency to a striking extent.

The investigator asked students to judge thirty-five nations and races by using the Bogardus Social Distance Scale. On the list, in addition to thirty-two familiar groups, were three fictitious ethnic groups—the "Danierians," "Pirensans," and "Wallonians." Evidently the students believed these nonexistent

groups were real, for those prejudiced against the existent groups also revealed prejudice against the nonexistent groups. In fact, the correlation between the social distance scores for the nonexistent groups and the real groups was about .80, a very high correlation.

Student comments revealed that some pervasive quality of the personality at least helps to determine prejudice. One of the intolerant students wrote on his paper concerning one of the fictitious groups, "I don't know anything about them; therefore I would exclude them from my country." In contrast, an unprejudiced student wrote, "I don't know anything about them; therefore, I have no prejudices against them" (Hartley, 1946).

Usually prejudice seems to be associated with a particular personality pattern characterized by moralism, a need for definiteness, authoritarianism, and an ambivalent attitude toward parents (Allport, 1954). One study of anti-Semitic college girls brought out a number of these characteristics.

On the surface the prejudiced girls seemed as well adjusted as their more tolerant classmates, but projective tests revealed a great deal of repressed hostility toward their parents. They tended to be very harsh in their moral judgments of others and to recognize no middle ground between extremes of right and wrong. In the Thematic Apperception Test they usually composed stories in which external events happened to the heroine instead of the heroine herself being responsible for her difficulties.

The basic insecurity of prejudiced persons tends to make them prefer situations in which there is a strong authority in control. Another expression of their love of order, especially social order, is in their regard for institutions. Thus the anti-Semitic college girls

were more devoted to such institutions as sororities and churches than were the tolerant girls (Frankel-Brunswick and Sanford, 1945).

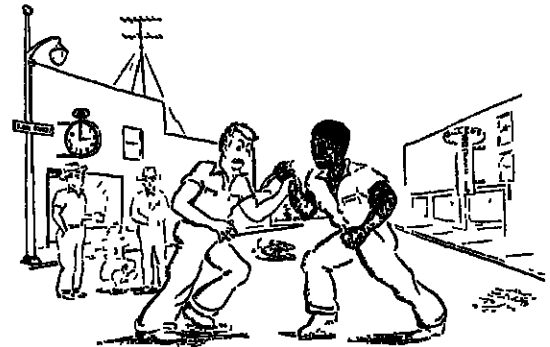
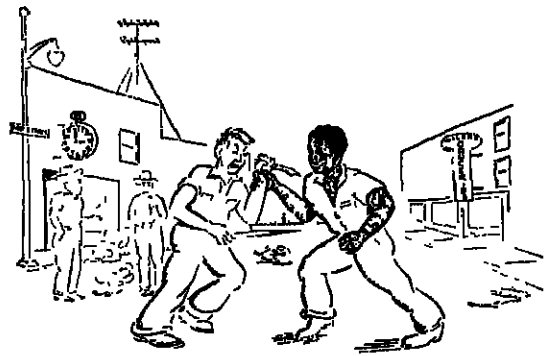
This love of institutions, extended to national scope, also appeared in a more recent study of causes of anti-Semitism.

Among the factors associated with anti-Semitism were insecurity, frustration, and a belief in a Jewish "essence." However, the investigators found that the most important single factor was "national involvement," or extreme and bigoted patriotism. This was measured by a series of statements asking for agreement or disagreement, one of which was, "Whereas some people feel that they are citizens of the world, that they belong to mankind and not to any one nation, I, for my part, feel that I am, first, last, and always, an American" (Morse and Allport, 1952).

Thus the prejudiced person is not a mere bundle of negative attitudes. Often he is positively striving for a safe island of security. When he chooses the nation as his refuge, he tends to distrust all foreigners, minority groups, or reformers who might disrupt the status quo. He fails to realize that he can regard himself as a citizen of the world without decreasing his love for his country, just as he can regard himself as a citizen of his state without decreasing his love for his city or his family group.



Scapegoating has been practiced against many groups and has taken many forms throughout history. For example, one very old approved social custom in Europe was the stoning of Jewish people during the Lenten season.



Slides like those above were shown to a group high in prejudice and a group low in prejudice. The high group remembered who held the knife significantly better than did the low group when the picture was consistent with their prejudice—that is, when the Negro was holding the knife. They did not differ from the low group in ability to remember when the white man was holding the knife, nor did they differ in memory of neutral items (Marchionne and Marcuse, 1955).

Scapegoating. Many psychologists feel that the primary mechanism underlying prejudice is scapegoating. As we saw in Chapter 7, aggressive feelings resulting from frustration are sometimes *displaced* from the true source of frustration to some other individual, group, or object. In some cases such aggression may be wholly unwarranted; in other cases the victim may have done something to provoke his choice as a scapegoat.

The term "scapegoating" comes from a ritual sacrifice common to many ancient peoples. The most famous of these ceremonies is the ritual of the Hebrews described in the Book of Leviticus. On the Day of Atonement the high priest, garbed in full regalia, laid his hands upon the head of a goat and confessed over it the iniquities of the Children of Israel.

By this procedure the sins of the people were supposed to be symbolically transferred to the animal, which was then driven into the wilderness. Believing their guilt to have gone with the goat, the people felt psychologically cleansed and free from anxiety.

Throughout history there has been a tendency to transfer guilt and blame to some person or group. The victims have usually been people or groups who stand apart because of some physical characteristic or some religious or cultural tradition. If the group is identified on the basis of physical characteristics of some kind, the hue and cry of racial inferiority is usually raised.

The prime causes of the aggression we see in scapegoating seem to be frustration, guilt, fear, and the need for self-glorification.

Frustration. We have already seen how the frustration-aggression sequence can operate. The principle that frustration arouses aggression, developed originally on the basis of clinical observation, has recently been given experimental validation. In one study, prejudice against Japanese and Mexicans increased after the subjects were placed in a highly frustrating situation (Miller and Bugelski, 1948). Another recent study, based on intensive clinical interviews with Army veterans who were not themselves members of minority groups, verified the hypothesis that persons who believed that they had undergone privation were disposed more than the average toward ethnic intolerance.

No relationship was discovered between socio-economic status, as measured by income, and intolerance. When the veterans were divided into three groups on the basis of social mobility, however, some very interesting relationships became apparent. Those who were moving downward on the income scale were more prejudiced against Jews and Negroes than was the group as a whole. Those who were moving upward on the socio-economic scale were less prejudiced than the average. Finally, those who were not moving either up or down were prejudiced just to an average degree (Bettelheim and Janowitz, 1950).

Guilt. Feelings of guilt are a second important cause of scapegoating. In modern America, as we have seen, sexual activity and "cutthroat" competition are frequent sources of conscious or unconscious guilt feelings. One of the most common reactions to guilt is to

project it onto someone else—that is, to blame other people for one's own real or fancied sins of omission or commission. Often guilt is projected onto members of other ethnic groups. Reports that Jewish businessmen are dishonest and unscrupulous, for example, may arise partially from the guilt feelings of Gentiles about certain of their own business dealings.

Fear and anxiety. Often strong fear and anxiety are resolved by aggressive behavior which does not necessarily discriminate between real dangers and illusory ones. This is particularly true in wartime. During World War II, for instance, anxiety about the possibility of subversive activity within the United States resulted in widespread suspicion of foreigners and minority groups. The internment of all Pacific Coast Japanese-Americans for many months, rather than the arrest of only those who could not stand up under scrutiny, was one example of such fear-motivated scapegoating. Another was the tendency to regard all Japanese-Americans as fifth columnists and to hold them responsible for the fate of Pearl Harbor when, in fact, the records do not show a single case of subversion among them.

The need for self-glorification. Still another basic motive in scapegoating is the need for self-glorification. Insecure people sometimes become closely identified with movements and causes which have as part of their program the scapegoating of others. By treating others as inferior, they believe they enhance themselves. For example, a German psychologist who was imprisoned by the Nazis tells how a number of individuals in the concentration camps—themselves victims of scapegoating—accepted as their own the values and attitudes of the Gestapo in order to protect themselves from breaking down under the dreadful psychological conditions of Dachau and Buchenwald. These people, taking over camp duties under Gestapo supervision, made other prisoners scapegoats and imitated guards in an effort to salvage their self-esteem and make themselves feel important. Here is scapegoating arising from intense personal need (Bettelheim, 1943).

Scapegoating is an important cause of prejudice, but alone it does not explain the development of a particular prejudice, and in some cases it does not seem to operate at all. Frustration does not always lead to aggres-

sion, nor is aggression always displaced. Furthermore, the available evidence does not show that highly prejudiced people have a greater tendency to displace their aggression than people who are low in prejudice. And even when scapegoating is clearly a factor in the development of prejudice, we must still find an explanation for the *choice* of scapegoats, who are not always defenseless minorities.

Social, economic, and cultural factors. Sometimes many members of a minority group actually have certain undesirable characteristics that help to make others prejudiced against them. In most cases such characteristics are the product of social, economic, and educational disadvantages which the victim of prejudice is apt to suffer—they are at once the product of prejudice and a cause of its continuance. Thus the scapegoating theory must not blind us to the necessity for realistically studying group characteristics (Zawadzki, 1948).

Prejudice can be reinforced, too, by the fact that people sometimes gain in social or economic status by keeping minority groups in an inferior position. Even political leaders sometimes capitalize on popular feelings of prejudice, in order to maintain their own popularity.

In many cases the explanation for prejudice is complicated by historical factors. An interesting study in Louisiana revealed that many people who were strongly prejudiced against Negroes had a favorable attitude toward Jews and other minority groups (Prothro, 1952). This exception to the typical pattern of prejudice—which, as we have seen, usually extends to a great many minority groups rather than just one—can be explained only when we consider anti-Negro attitudes in relation to the total culture and tradition of the South.

WHAT CAN BE DONE

ABOUT PREJUDICE?

Because most prejudices are learned at an early age and are sustained by such a complexity of factors, the problem of eliminating prejudice is an especially difficult one. There is encouraging evidence, however, that ethnic prejudices—especially anti-Negro attitudes—are declining in strength (Mayo and Kinzer, 1950). This trend revealed itself for a number

of years—even preceding the Supreme Court decision against school segregation in 1954—in the desegregation of churches, schools, housing projects, restaurants, and other facilities in many communities.

As there is no single cause of prejudice, there can be no single cure. The most important ways for eliminating or reducing prejudices of all kinds seem to be through education, intergroup contacts—including working together toward common goals—and legal action.

Education. An educational program against prejudice must take several directions:

1. The reduction of prejudice and scapegoating must begin with the elimination of the bias-breeding instruction of children by the home, school, comic strips, movies, and other media of communication.
2. People must be brought to understand scapegoating—to understand their own motives and the irrationality of their own prejudices. They must understand that scapegoating represents a widespread human tendency to shift psychological burdens onto other people. Likewise, they must understand that scapegoating solves no problems—persecuting Jews did not help the Germans solve their problem of national humiliation, although it may have brought momentary relief from feelings of frustration and insecurity.
3. There is no longer any serious doubt about the potential equality or near equality of the so-called races, nor is there any doubt whatever that variability among people is greater *within* groups than it is *between* groups. This fact must be made known.
4. People must learn that prejudice and resultant scapegoating are not inevitable correlates of community life. Widespread information about the variation in prejudices from culture to culture can help give perspective on our own prejudices.
5. Since intolerance is often a function of ignorance, efforts should be made in the schools and elsewhere to introduce people to the character, culture, and achievements of groups different from their own.

Minority as well as majority groups can help cure prejudice through educational programs. Victims of prejudice should educate themselves to an understanding of the dominant group's prejudice and examine those

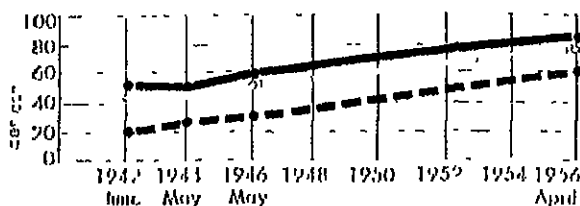
Changing Attitudes Toward Desegregation

The attitudes of the white population of the United States toward the segregation of Negroes have changed between the years of 1942 and 1956, according to scientific sampling surveys conducted by the National Opinion Research Center. The three bar charts at right show the change in attitudes for three kinds of segregation, comparing the results in 1942 and 1956 first for the total white population and then for the white North and white South.

The questions used to obtain these figures were: (1) "Do you think white students and Negro students should go to the same schools or to separate schools?" (2) "Generally speaking, do you think there should be separate sections for Negroes in streetcars and buses?" (3) "If a Negro with the same income and education as you moved into your block, would it make any difference to you?"

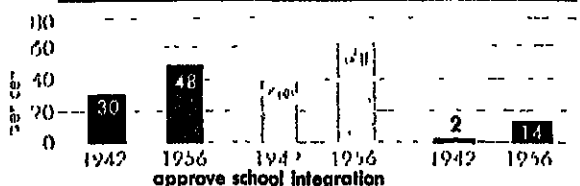
One reason for the shift in attitudes may be seen in the dramatic change (top right) in people's answers to a more basic question, "In general, do you think Negroes are as intelligent as white people—that is, can they learn things just as well if they are given the same education and training?"

Adapted from Hyman and Sheatsley, 1956

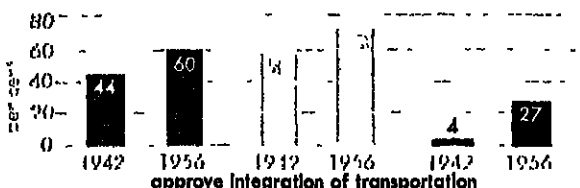


believe Negroes are as intelligent

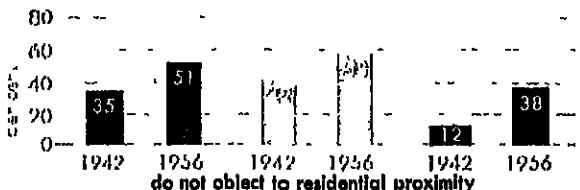
white North white South white total



approve school integration



approve integration of transportation



do not object to residential proximity

aspects of their own behavior which others have found objectionable. Without losing their identity in any way, they can minimize the conspicuous display of traits with marked negative symbol value (Williams, 1947).

Intergroup contacts. Prejudice is occasionally accentuated by casual intergroup contacts—isolated instances in which the prejudiced person expects (and therefore perceives) unpleasant behavior on the part of some member of a minority group. Usually, however, contact between groups has a profound effect on the reduction of prejudice. People who have personal acquaintances among minority groups tend to show little prejudice toward those groups. To foster the development of such first-hand knowledge, modern educators not only teach facts about other ethnic groups but offer students opportunities to visit such groups when possible. The relationship between intolerance and ignorance was clearly brought out in an early study of national prejudices.

College students were asked to rate ten national groups with respect to a number of traits. The subjects were then classified according to the amount of travel they had done in foreign countries. A consistent lessening of prejudice was found according to the amount of time that a student had spent in the nation he was asked to rate. In other words, the better acquainted a student was with a country, the more favorable was his attitude toward it. Furthermore, the greater his first-hand experience with any foreign nation, the less was his prejudice toward all foreign countries (Diggins, 1927).

Similar results were obtained in a study sponsored by the United States Air Force, which had a team of social scientists study attitudes of our personnel toward native populations with whom they were in contact during the Korean War. It was found that the longer officers and enlisted men lived among the Japanese and Okinawans, the higher were their opinions of them (Human Resources Research Institute, 1951).

Other studies in the armed services have shown that personal contact between white and Negro servicemen definitely tended to reduce prejudice. One investigator commented:

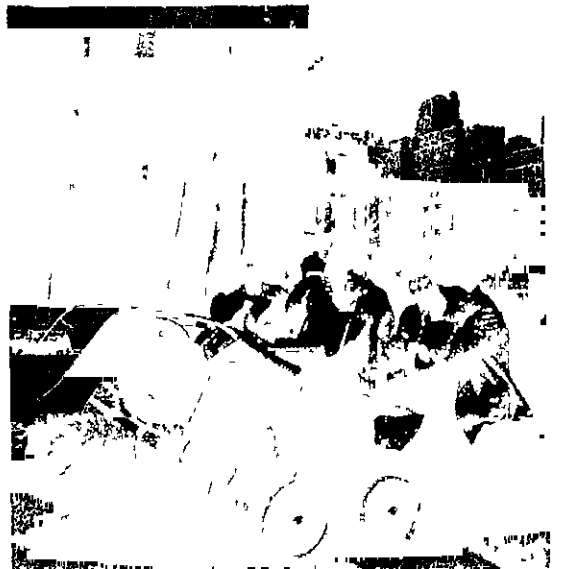
"Put a white man and a Negro soldier in the same shell hole, and they will fight together to the last breath, sharing their food and water; if either is wounded the other will risk his life to carry him out. But the shell hole must be large enough for both of them" (Singer, 1948).

On the whole, the experience of working together toward the common objective of victory seemed to promote friendly relations between ethnic groups in the service.

We might expect to get similar results from the participation of various groups in community activities that are considered necessary to the common welfare (Williams, 1947). Sherif and Sherif found in their study of boys at camp, described in the preceding chapter, that prejudice increased when one group thought its goals were being blocked by the other and lessened when the groups had to work together to solve a common problem (Sherif and Sherif, 1956).

Intergroup contact may have either good or bad effects in areas where Negroes or other minority groups are moving into residential districts formerly inhabited exclusively by the majority group. During the transitional period, competition for housing and the majority's resistance to change may increase whatever prejudice and hostility already exists. However, after two or more racial groups are actually settled in the same neighborhood, prejudice tends to decrease, as revealed by several studies of areas in which some housing projects were segregated for Negroes and whites and others were not. As the whites learned that the Negroes were as careful of the property as they, relatively few of them expressed any dislike of Negroes as neighbors (Allport, 1954).

In one study white residents were asked whether the Negroes were pretty much the same as the whites or different. Of those who lived in integrated housing units, 80 per cent said they were much the same, as compared to only 57 per cent of the segregated dwellers. When asked to indicate the chief faults of Negroes, the white people living in segregated units mentioned rowdiness and other trouble-



Intergroup contact usually changes the nature of the prejudice between the two groups and often tends to lessen it. These Negro and white mothers, chatting about their common interests and problems as they sun themselves and their babies in the Alfred E. Smith housing development in New York, may find that their attitudes toward each other have been based on misconceptions.

making traits. But those who lived in the integrated units mentioned instead such traits as inferiority feelings or oversensitiveness, indicating a sympathetic attitude (Deutsch and Collins, 1951).

Even if prejudice does not decrease markedly, its nature tends to change with closer contact.

The investigator marked off five zones, Number 1 being at the point of contact with the expanding Negro movement and Number 5 being the most remote, two or three miles away from Negro dwellings. Residents of all zones were questioned as to their reasons for wanting to exclude Negroes from their neighborhood. Whereas 25 per cent of those living in Zone 5 gave the reason that Negroes were dirty, smelled bad, or were otherwise physically unpleasant to associate with, this percentage decreased in each nearer zone until only 5 per cent of those in Zone 1 expressed such feelings. In contrast, 22 per cent of Zone 1 residents, as compared to only 10 per cent of those in Zone 5, expressed the fear of social mixing and intermarriage as their children came into contact with Negroes (Kramer, 1950).

Thus while all whites tended to regard the approaching Negroes as a threat, the nature of their fears or dislikes varied with the nearness of the threat.

A frequent argument against integrated housing is that Negroes themselves prefer to live only with Negroes. However, this belief has been shown to be false.

When Negroes living in a segregated unit were asked if they would object to white neighbors, 100 per cent said they would not. In contrast, 78 per cent of white dwellers in a segregated project said they would not want Negroes to be admitted there (Aronson, cited in Allport, 1954).

In general, intergroup contacts seem to be the most effective way for curing prejudices. Through such contacts people are able to discover for themselves that there are no unbridgeable gaps between different groups of mankind.

Legal action. It must be remembered that attitudes cannot be legislated. Nevertheless, the law can do much to eliminate conditions that are favorable to the development or maintenance of prejudiced attitudes. Undoubtedly the most dramatic legal step toward the elimination of racial prejudice in this country was the Supreme Court's decision, in May 1954, that segregated public schools were unconstitutional.

One study has been made in Texas of attitudes toward the decision itself. There Negroes were admitted to the University of Texas without incident, in spite of the fact that a poll had reported a majority of both whites and Negroes as favoring separate universities.

In an attempt to obtain a more accurate sample of Texas opinion, the investigators obtained responses from 230 teachers, white and Negro, to a questionnaire concerning their opinions on nonsegregated education. Although 92 per cent of the white teachers and 95 per cent of the Negroes agreed in principle with the recent Supreme Court decision, considerably fewer favored its actual enforcement in Texas schools. Only 44 per cent of the white and 57 per cent of the Negro teachers completely approved mixed classes at all grade levels. However, only 4 per cent of the white and 1 per cent of the Negro teachers wanted complete segregation. The percentage of both whites and Negroes approving desegregation dropped in moving from graduate and

professional to grade school level of education. White teachers who had attended mixed classes were more tolerant than those who had not. Those who were married and those who were recently out of college expressed more approval of nonsegregation than did those who were single or those who had taught for a number of years in the segregated schools (Turman and Holtzman, 1955).

Another study in the same series measured the attitude of 539 college undergraduate men in Texas toward segregation (Holtzman, 1956). Only 6 per cent of the whole group completely approved of segregation, and 26 per cent wished to abolish it. However, when the subjects were grouped according to the area of Texas in which they lived, sharp regional differences appeared, with those from East Texas and the Gulf Coast being much more intolerant than those from central or western Texas. Other factors also proved to be correlated with degree of tolerance. For example, students majoring in the social sciences and humanities were considerably more tolerant than those majoring in pharmacy or business administration. Those professing unorthodox religious beliefs were more tolerant than those who held traditional concepts of God. However, those who attended church regularly and those who attended rarely or never were approximately equal in tolerance and were more tolerant than those who attended church once or twice a month.

One psychologist, basing his ideas on numerous examples of local desegregation, has arrived at a number of principles about the ways in which desegregation can best be put into effect (Clark, 1953). For example, he found that methods of gradual desegregation are not necessarily more effective or more likely to gain easy acceptance. On the contrary, gradual measures often are met by more active resistance, simply because continual changes must be introduced over a period of time and those opposed to the changes have more opportunity to organize their resistance.

By promoting intergroup contacts, legislative action can pave the way for better understanding between groups. But we must remember that it cannot in itself cure prejudice. The causes of intergroup hostility are too complex and deeply rooted for anyone to hope that prejudice can be legislated out of existence. Legal steps toward eliminating

prejudice must always be accompanied by a thorough program of education and by a genuine effort on the part of all groups—majority and minority—to understand themselves and each other.

SUMMARY

The happiness of all of us depends largely on our success in group living, yet problems abound in this area. Three problems which have attained national significance are broken marriages, delinquency and crime, and prejudice.

Success in marriage depends on finding the right person and becoming the right person. Studies of marriage and divorce indicate that the development of a cooperative attitude contributes most to marital success. Complementary personalities, shared interests, and economic security all favor happy marriages, which seem to run in families. Emotional immaturity, hasty marriages, and money troubles frequently lead to marital failure, but differences in age and in religion do not seem to be major causes of divorce.

In general, happy marriages result from successful interaction of the total personalities of the partners, and it is therefore difficult to design predictive tests for marital success. Happy marriages tend to follow happy engagements.

Delinquency—that is, illegal behavior by minors—is a pressing social problem. The causes of delinquency (delinquents are made, not born) include *poverty, residence in transitional areas, family breakdown, and emotional maladjustment*. Low intelligence seems to be a very minor cause, and there is little agreement on the influence of movies, television, and “comic” books. The vitally important problem of predicting criminal behavior has not yet been solved.

The major avenues to crime prevention are *community action*—involving social organizations, slum-clearance projects, professional social workers, and self-help neighborhood drives—and *judicial action*. One set of proposals for dealing with delinquents calls for the separation of judicial and penal functions; the provision of adequate personnel; rehabili-

tation instead of punishment; exclusive control by public authority; a uniform system for the entire nation; improvement of police, judicial, and institutional reform practice; and abandonment of artificial criminal classifications. These proposals recognize the emotional and social foundations of delinquency.

Racial antagonism, rising out of prejudice, is a grave national problem. Yet the very term “race” has little meaning. Human differences are continually being produced through *the inherent variability of genetic materials* and through *gene mutation*; therefore, any scheme for classifying races can have validity for only a brief time. Physical characteristics are unreliable indices of racial “differences,” and psychological characteristics seem to result from environmental rather than hereditary influences. It has been suggested that *ethnic group*, a primarily social division, be substituted for *race*, a biological division.

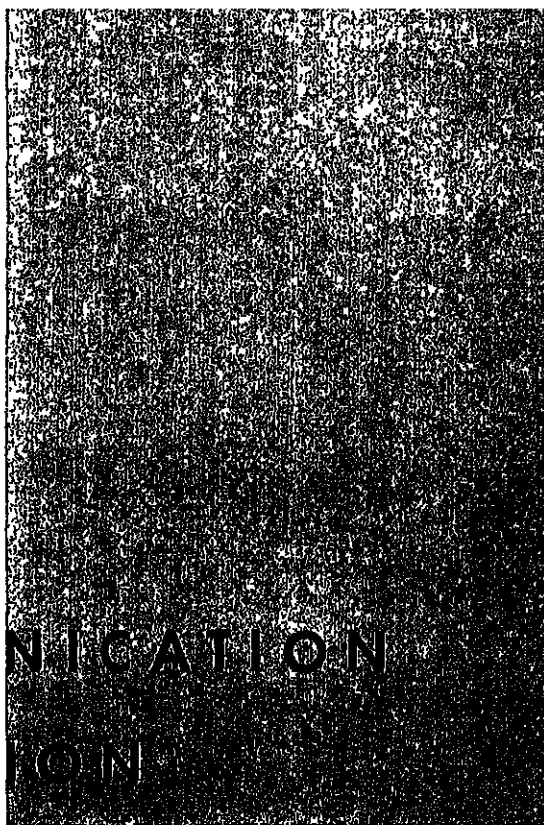
Prejudice, in the form of extreme nationalism, is a major threat to world peace, but man is not born with prejudice. He is conditioned to prejudice by isolated experiences or, very frequently, by exposure to the prejudiced attitudes of his parents, teachers, and companions. “Racial” stereotypes presented by the mass media also have an influence. Thus the child who has no prejudices in nursery school may be violently prejudiced by the time he reaches the eighth grade. Some people seem to be antagonistic toward all groups other than their own. This generalized prejudice is often the result of a striving for personal security.

Aggressive feelings growing out of *frustration, guilt, fear and anxiety*, or the *need for self-glorification* are often turned against a minority group. Many psychologists feel that such *scapegoating* is the primary mechanism underlying prejudice; but scapegoating does not always seem to operate and, alone, it does not explain the development of a particular prejudice, which may result from a variety of social, economic, and cultural factors.

There is no single cure for prejudice, but *education, intergroup contacts, and legal action* are all effective medicines. While attitudes cannot be legislated, the law can help eliminate conditions favorable to the development or maintenance of prejudices. To succeed, however, legal steps must be accompanied by education and by genuine efforts at mutual understanding and self-understanding.

CHAPTER SIXTEEN

MASS COMMUNICATION AND PERSUASION



EDUCATION FOR DEMOCRACY

PROPAGANDA AND ADVERTISING

MEASURING GROUP OPINION

An essential part of the present-day American scene is our enormous use of mass communications. Churches, schools, newspapers, magazines, motion pictures, radio, television, public lectures, and discussion groups are all examples of mass communication media. Sometimes this communication is properly referred to as mass education; in other cases it must be classified as propaganda or advertising.

Most psychologists agree that advertising and propaganda comprise any organized mass communication employed to change the attitudes and behavior of people with regard to some vested interest—either a commercial product or some partisan position. Education also uses various “persuasive” techniques, but it tries to implant in people the skills whereby they can develop their own attitudes and solve their own problems in the light of the best information available. The propagandist and the advertiser differ from the educator in not caring about the individual’s ability to discriminate and solve problems—their goal is immediate and specific action. For this reason they make much greater use of emotional appeals than does the teacher.

Education, advertising, and propaganda all may use the same media of mass communication. An important goal of each is to persuade. But their ultimate aims and their means of persuasion are significantly different.

EDUCATION FOR DEMOCRACY

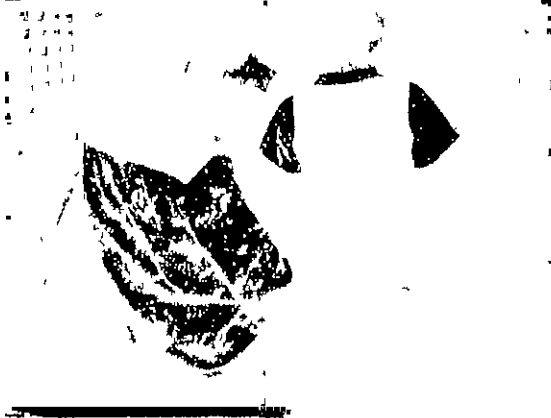
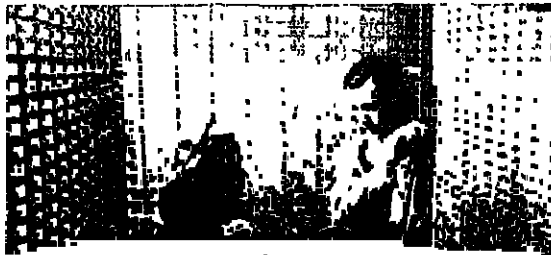
American education is designed to do two main things: (1) to pass on the culture developed by past generations and thus to help young people grow into their adult roles as democratic citizens and (2) to advance knowledge by training young people in the techniques of scholarship and research.

THE AIMS OF EDUCATION

The past several decades have seen vast changes in both the aims and methods of education. These changes have been chiefly an outgrowth of our increasing knowledge of child development and of the learning process. Educators today believe that education is more than pouring from the big jug into the little mug—that the teacher is more than a filling station attendant who connects the big tank of knowledge in the textbook with the little tank in the child’s mind. Parents and the community, too, are coming to have a broader view of education. No longer content

to have children acquire only factual, academic knowledge, they feel that the school’s responsibilities include helping children to develop the skills and understandings they need to become mature citizens. The best schools today help students to:

1. Learn and practice intelligent self-direction.
2. Gain an understanding of themselves as human beings (how they are made and grow, why they think and feel and act as they do).
3. Acquire the skills, understandings, and behavior essential for physical, mental, and social well-being in a democratic society.
4. Gain an understanding of their own and other cultures and the interrelationships between cultures.
5. Acquire the skills, understandings, attitudes, and behavior essential for effective participation as citizens in a democracy.
6. Gain an understanding of their physical environment and their relation to it.
7. Acquire the skills, understandings, attitudes, methods of thinking, and behavior



Modern educators believe that the schools should not only help children acquire factual knowledge but also help them prepare for mature citizenship. In the Cleveland, Ohio, elementary schools, this preparation includes learning about banking and savings. Each week the children deposit their coins at school, where some of the older students, with the necessary background in arithmetic, act as tellers and bookkeepers. After the deposits have been tallied, the total is deposited at the Children's Banking Department of a local bank. At regular intervals the children tour the bank to see how it operates and just what happens to their money. The bank, as well as the school, believes that this program is a sound preparation for citizenship; it continues to conduct the program even though its operation results in a considerable annual loss.

essential for survival and progress in a democratic world society.

8. Acquire the skills, understandings, and behavior essential to the intelligent and competent use of quantitative ideas as required by our culture.

9. Acquire the abilities, skills, and understanding needed to express their own ideas effectively when speaking or writing to others and to interpret what others say and have written. Gain an understanding and appreciation of what others express through line, color, sound, rhythm, fabric, wood, metal, stone, and the like; and acquire ability to express themselves through different media.

10. In all these areas develop interests, tastes, ideals, values, and discrimination through listening, reading, talking, writing, making choices, participating, and evaluating.

So far we have talked only about the broad purposes of American education. But we must also consider the purposes—or motives—of teachers and students. A teacher's purposes influence what he teaches and how he teaches it; a pupil's purposes influence what he learns and how easily he learns it. Ideally the purposes of teacher and learner should coincide, but this seldom happens without careful planning. The teacher must often use his teaching know-how to "persuade" his students to learn those things which he and the school consider important. He can use his position of authority to say "you *must* learn this." But a much more effective method generally is to capitalize on the learner's own purpose—adapting learning material to his particular interests and needs and helping him enlarge and improve his personal goals.

Learning as "behavior change." Teaching today is usually defined *not* merely as the process of transmitting knowledge but also as fostering, guiding, and identifying desirable *behavior change*. The value of a student's acquiring knowledge must be judged in terms of what it leads him to do—how it affects his behavior. One kind of behavior change is acquiring competence in arithmetic processes and learning to read with skill and understanding. Another is learning how to attack and solve problems. Another is learning of effective group participation and cooperation. Still another is learning to respect differences between individuals.

Modern educators believe that children will be most likely to apply the results of

their learning if they learn in an environment similar to that of the world outside the walls of the school. In fact, they prefer the term "laboratory" to the term "classroom," for they think of the school as a good place to practice the skills and techniques of living in a modern democratic society. Our growing knowledge of the way people learn in everything they do—regardless of whether or not anyone is consciously teaching them—makes it clear that children *will* learn attitudes and values and behavior patterns in school, whether the school plans for them or not. By recognizing and accepting this, the modern school has assumed a new responsibility for everything it teaches. It has agreed to try to foster the best learning possible in all the various areas of living.

Learning through experience. Perhaps the chief reason why the aims and methods of the modern school have changed is that psychologists and educators have developed a new concept of the learning process. In recent years American education has come to be guided by the principle of *learning by doing*. One of the basic tenets of all experimental psychology is that without experience there can be no learning.

Children achieve maximum growth when each new learning experience is related to experiences they have already had and when new learnings are related to each other. Vicarious experiences—such as those available through reading—can be as meaningful and vital as direct experiences. If, as he reads, the learner is able to form vivid sensory images, comprehend what the author means, react to what the author has said, and integrate what he reads with what he already knows, then reading is experiencing—just as living is.

ALLOWING FOR INDIVIDUAL DIFFERENCES

Since children of any age vary tremendously in their intellectual maturity and ability to learn, one of the greatest problems of our schools is to provide learning experiences geared to the needs and abilities of all the children in a classroom. Even in the lower grades a range in mental age of two or more years is common. A study of 2282 children in 112 first-grade classrooms showed that their mental ages ranged from four years and

seven months to nine years and three months (Horton, 1952). As we saw in Chapter 4, such differences become increasingly greater as children grow older, since their mental growth is proceeding at different *rates*. A study in New York State found a nine-year range in the mental ages of fourteen-year-olds, as shown in the chart below (Segel, 1948).

Differences in intellectual maturity are further complicated by differences in physical, social, and emotional maturity. Obviously teaching and classroom procedures must be adjusted to meet the individual needs created by such differences. If slow learners are allowed to set the pace for the entire class, they retard the progress of the group, and the brighter pupils may become bored and troublesome. If the fast learners set the pace, on the other hand, the slow ones become discouraged and humiliated by their inability to keep up. Often they become serious behavior problems.

Many attempts have been made to meet the problem of individual differences among children in the elementary schools. In those rare classrooms where the number of children is small, teachers may try to give instruction on something like an individual basis. In most situations, however, this is impossible—and in any case the best teaching makes use of the group to help teach individuals. The procedure being used in most schools today is to group the members of a class according to ability so that instruction in arithmetic or reading, for example, may be geared to the special needs of slow learners, average learners, and fast learners.

Distribution of Mental Ages for
Fourteen-Year-Olds in New York State



Based on Cornell, 1936

Although the practice of grouping seems the best way to meet the problem of individual differences in the average classroom, it is not without its disadvantages. Particularly serious is the danger of creating feelings of high and low status in children—though this difficulty can often be overcome by keeping group membership flexible and by using different groupings (sometimes based on common interests or other factors besides ability) for different activities. And in spite of wide variations in ability, all class members can often work together on a common project, each child contributing in the area of his greatest strength. In order to plan for the most effective learning experiences, a teacher must consider children's social and emotional needs as well as their intellectual abilities.

Adjustment of curriculum content and teaching methods to the individual is an important consideration not only with school children but also with adults in industrial and military training programs. This was clearly demonstrated in a recent study conducted to determine the optimum number of practice problems to include in an Air Force electronics course.

Three experimental training courses were conducted. In Course I the trainees were given one practice problem after each unit of course material. Course II contained twice as many practice problems, and Course III contained three times as many. There was a wide range of individual differences in the intelligence of those taking each course. The results of the study showed that, in general, the trainees who took Course II obtained higher scores on a final written examination than the trainees who took either Course I or Course III. However, when the I.Q.'s of the trainees were taken into account, it was found that the superiority of Course II held only for trainees who were average or higher in intelligence. For trainees with I.Q.'s below 100, the highest achievement was obtained among those in Course III, which contained more practice problems. Thus, for trainees of average or higher intelligence, Course II appeared to be the most desirable, whereas Course III produced the best results for below-average trainees (Warren, Dossett, and Ford, 1957).

CURRENT CURRICULUM DESIGNS

The curriculum has been variously defined in educational literature as everything from

"a systematic group of subjects required for graduation" to "all the experiences of a particular individual from the moment of birth." Most curriculum specialists today agree on a definition of the curriculum as all the learning experiences of children for which the school is responsible.

There are many different patterns of curriculum design. But like skirt patterns—which are all adapted from the basic designs of two, four, and six gores—they are adaptations of three basic plans—*unstructured*, *integrated*, and *subject* curricula.

The *unstructured* design is variously identified as the "experience curriculum" or the "child-centered curriculum." Under this plan, learning experiences are initiated and their direction and sequence determined by the immediate interests of the learner. The goal is to answer children's questions and satisfy their interests and curiosity without reference to a predetermined sequence of learning experiences, skills, understandings, and knowledge, or to subject matter boundaries.

The *integrated* design is variously identified as the "activity curriculum," the "core curriculum," and the "fused curriculum." It is one in which subject matter boundaries are largely ignored. All offerings of the school are taught as mutually interrelated aspects of some life situation. In this design the learning experiences are initiated and their direction determined by the teacher's manipulation or by joint planning by teacher and students.

The *subject* design is the traditional one most of us know best from our own school experience. When this design is followed rigidly, each subject is studied separately and learning experiences for the most part consist of mastering the facts or skills presented in a textbook. The logic and nature of the subject determines the direction and the sequence of the learning experience.

We can take a typical sort of learning experience to illustrate the three designs in "pure" form. Today every town of five thousand has a fire station. One type of learning experience for which all schools take some responsibility is helping children to understand and appreciate the community's provisions for fire protection. In the unstructured curriculum this learning experience might be initiated by some child's asking a question about the fire station, by a child's bringing a toy fire truck to school, or by a fire in the

neighborhood. It might even be initiated by a child's reading about a fireman in a library book. The question, the interest, the environmental stimuli might be followed by a visit to a fire station, by having the fire chief come to talk, by building a block fire station. Any one or all of these experiences might lead to reading, to language activities, and to gathering more information.

In the integrated curriculum there might be a unit on community helpers, in which a problem might be stated: "How is our community protected?" This learning experience might even be a part of a broader unit dealing with "Our Community." The learning activity might be initiated in any one of a number of ways. The teacher might capitalize on the fact that the father of one of the children was a fireman. She might point out the fire station. She might raise a question about the community's provision for protection. She might show pictures or a movie. Eventually, through her manipulation, a trip to the fire station would evolve.

In a pure subject-centered curriculum the children might read an assigned lesson in a book, answer questions asked by the teacher, and never be called upon to associate what they had read with their own community's provision for fire protection. There might or might not be integration of the knowledge gained from the book with their own experience.

It would be difficult to find a "pure" example of any one of these designs in operation in a school today, though it is usually possible to distinguish the controlling design. In general there is a trend to integrate subject areas with each other and with a child's out-of-school experiences, but this can be done with quite different types of curricula.

Actually the curriculum design itself is not as important as the selection of materials and learning experiences appropriate to a child's level of maturity. Regardless of the plan under which he is taught, a child will not learn anything for which he is not ready. As their knowledge of child development has increased, educators have discovered that certain concepts were being presented to children too early and could be taught much more successfully to students with greater maturity. Other concepts, they discovered, could be taught most effectively at an earlier age than previously thought. With any cur-

riculum but a totally unstructured one, it is possible to provide sequential learning experiences which build upon what children already know and which at each point fit their needs, interests, and stage of growth. The modern writer of textbooks tries to present material in a way that will have interest and utility for the student—and to present it in the order in which it will be most easily learned. As we have already seen, educators today no longer accept the old notion that subjects lacking in interest and usefulness can "strengthen the mind."

A revealing study of the relationship between education at the secondary level and success in college was conducted by the Commission on the Relation of School and College of the Progressive Education Association.

The first step in this study was to secure the cooperation of the colleges of the country in accepting students from thirty progressive secondary schools without the customary formal transcript of "college preparatory" units. With this accomplished, the thirty schools, distributed throughout the country, were free to reorganize their curricula. Each school made its own plans with the aid and cooperation of the Commission. Once a year, from 1933 through eight years, the principals and teachers of the schools met with the Commission to discuss their problems, findings, and new ideas. On the whole, they all followed two major principles: (1) The general life of the school and methods of teaching should conform to what is now known about the ways in which human beings learn and grow. (2) The high school in the United States should rediscover its chief reason for existence, i.e., it should give the youth an understanding and appreciation of the way of life we call democracy through living a truly democratic life every day at school in relationships with teachers and with other students.

An example of the type of curriculum found in the thirty schools is taken from a Denver high school in which the students took a "Core Curriculum" for two hours every day throughout the high school period and then were free to choose their other subjects, which were all oriented to what they desired to do after they graduated. The "Core Curriculum" took up such problems as the following: (1) understanding ourselves through discovering our interests, aptitudes, and powers; (2) developing interests and appreciations which we already have and exploring others in such fields as reading, painting, singing, etc.; (3) exploring the problems of living in a modern family; (4) studying the problems of human relation-

ships (boy-and-girl relationships, for example); (5) studying the community, its history, its government and taxation, etc.; (6) discovering the unique characteristics of American democracy and comparing them with the other methods of political and social organization of the world; (7) studying economic problems such as consumer problems, living conditions under a machine civilization, vocational opportunities, and employment problems.

For four years, beginning in 1936, the members of the College Follow-up Staff studied 1475 matched pairs of students, one student in each pair coming from a traditional high school and the other from one of the thirty progressive high schools. The students were carefully matched on the basis of intelligence; sex; race; age; church affiliation; size and type of secondary school, public or private education; size, type, and geographic location of home community; the socio-economic status of family; extracurricular activities in secondary school; and vocational objectives.

This study included reports by the college on the students' academic and extracurricular achievements, as well as conferences with the students themselves. It was found that the graduates of the thirty schools:

1. earned a slightly higher total grade average;
2. earned higher grade averages in all subject fields except foreign language;
3. specialized in the same academic fields as did the comparison students;
4. did not differ from the comparison group in the number of times they were placed on probation;
5. received slightly more academic honors in each year;
6. were more often judged to possess a high degree of intellectual curiosity and drive;
7. were more often judged to be precise, systematic, and objective in their thinking;
8. were more often judged to have developed clear or well-formulated ideas concerning the meaning of education—especially in the first two years of college;
9. more often demonstrated a high degree of resourcefulness in meeting new situations;
10. did not differ from the comparison group in ability to plan their time effectively;
11. had about the same problems of adjustment as the comparison group but approached their solution with greater effectiveness;
12. participated somewhat more frequently, and more often enjoyed, appreciative experiences in the arts;
13. participated more in all organized student groups except religious and "service" activities;
14. earned in each college year a higher percentage of nonacademic honors (officership in organiza-

tions, election of managerial societies, athletic insignia, leading roles in dramatic and musical presentations);

15. did not differ from the comparison group in the quality of adjustment to their contemporaries;

16. differed only slightly from the comparison group in the kinds of judgments about their schooling,

17. had a somewhat better orientation toward the choice of a vocation;

18. demonstrated a more active concern for what was going on in the world."

It is quite obvious that these progressively run high schools did not leave students with a poor background for college work—a false charge often made by ultra-conservatives. In fact, their graduates were a little more frequently the recipients of academic honors, such as Phi Beta Kappa and the Dean's List, than were the graduates of more traditional schools. Nor did they turn out a group of pampered young people who were incapable of leadership. In fact, 45 per cent of students who had participated in the experiment won nonacademic honors (such as class and student-body offices, debate and athletic managerships) as compared with 40 per cent of the students who graduated from traditional high schools (Aikin, 1942).

At one time the results of this study would have been used as ammunition in the fierce controversy between "progressive" and "traditional" educators. As is frequently true when a new ideology appears on the scene, the two forms of education were once represented as being poles apart. But with time the extreme progressivists have come to recognize their own defects, at the same time that the more traditional educators have come to accept the sound principles emphasized by the progressive group. Today more and more schools throughout the country—both private and public—are moving toward a working integration of traditional and progressive theories of education.

GROUP DYNAMICS

IN EDUCATION

The application of group dynamics (Chapter 14) to the classroom has made it possible to capitalize on the differences in ability and background among students. This method—sometimes called that of *participative action*—is still in the experimental stage, but there is increasing evidence of its effectiveness in educating persons of all ages. Because it encourages contributions from all members of

a group, it also tends to minimize the undesirable effects of excessive competition.

In a recent experiment tenth-grade children were placed in two learning situations which differed greatly with regard to the function and importance of the teacher. In one situation the teacher produced a "group-centered" climate; in the other an autocratic, "teacher-centered" climate. A record was kept of what the teacher said and what the pupils said. Various measures were also made of the pupils' emotional reactions, such as those revealed by the galvanic skin reflex. Two weeks later, tests were administered to determine how much of the material taught in the experimental classes could be recalled. The results showed quite clearly that autocratic methods, although traditional in the classroom, produced more emotional tension (as objectively measured) and less ability to recall the materials learned than did the democratic, group-centered method (Flanders, 1951).

Another study compared two college classes taught by democratic methods with two other classes taught by traditional lecture methods. The groups were matched as to scholastic achievement and attitudes toward democratic processes.

One of the democratic classes became dissatisfied with the grading system which they themselves had worked out and tended to extend their unfavorable feelings to other phases of the work. The other, however, showed significantly more positive evaluations of the class and better acceptance of group decisions than did its matching lecture class. Some of the highest achievers scholastically took little part in classroom activities, apparently concentrating on making good grades in the traditional manner. The investigators concluded that the most effective class is one which is organized to facilitate team activities, which employs some group incentive in the grading system, and in which the instructor maintains a warm relationship with the students, allowing them a good deal of authority (Johnson and Smith, 1953).

Oddly enough, students sometimes prefer authoritarian methods of teaching.

This was indicated by a study in which college students were asked which of three methods they preferred (both before and after a semester during which they were taught by all three): traditional recitation, free discussion, and study-tutorial. In the last-named method the instructor consulted individually with students, who spent the session reading.

At the end of the semester the majority preferred the recitation method. The investigator believed that this was because they felt less anxiety under that method, which was most familiar to them and was highly structured so that they "knew where they were" at all times (McKeachie, 1951).

Similar results were obtained by another investigator who found that, on the whole, students preferred directive to permissive classes. This was particularly true of those who were least secure and independent in their personality patterns (Wispe, 1951).

Feeling that authoritarian methods—even though they might be preferred by most students—are a poor preparation for life in a democracy, McKeachie and Bovard undertook a further study to see whether or not group-centered methods would produce as much learning as traditional methods and at the same time satisfy student needs.

These investigators used a group-centered teaching method in half of their psychology classes. Each student was given a seating chart showing the names of other students; the instructor referred questions from one student to another; and students helped in making up tests and determining the grade system. One section of the class had breakfast together, and another had an evening party during the semester. The investigators taught the students in the other half of their classes by traditional methods, with the instructor trying to interpose himself between any student interactions. In the group-centered classes the instructor tried to eliminate the student anxiety which so often goes with nontraditional teaching methods by offering initial support, by building up the group as a supporting agency, and by creating a permissive social climate.

Final examination scores of the two groups showed no significant difference. However, students from the group-centered classes showed more independence in their thinking—that is, less tendency to conform to group norms of opinion, as measured by attitude scales. As a further test both groups were shown a film about a girl who experienced feelings of rejection. Recordings were made of the class discussion that followed; these were evaluated by clinical psychologists as to the degree of insight shown by the two groups of students. They found that the group-centered classes were much more sensitive to the expression of feelings and the mechanisms used to deal with conflicts, were less frightened by the film, and showed a high degree of interaction and spontaneity. The traditionally taught students, on the other hand, appeared insecure, aggressive, and

formalistic. Most of them showed little insight into the underlying dynamics of the film situation and tended to label things with "black names" to such an extent that they were unable to cope with the real issues involved (McKeachie, 1951; Bovard, 1952).

Thus, although students taught by the group-centered method did no better on the final examination than those taught by the authoritarian method, their learning gained an important new dimension. Authoritarian leadership in the classroom eliminates the "incidental" learning of many kinds of personal and social skills.

The introduction of group dynamics in the classroom presents many difficulties. The orientation of many school systems and many teachers is still authoritarian, and the average student expects the teacher to be an authoritarian leader. If the teacher attempts to move from traditional authoritarian methods to those of participative group action, he often finds that students have difficulty adjusting to the change. They may become anxious and tense and complain that "Nobody tells us what to do." If the teacher attempts to use the newer methods from the start with a fresh class, he himself may be subject to anxieties. He must be very secure emotionally to face the possibility that the activity will "get out of hand," or that it will fail to equip the student for an examination, or that the student will feel he is "not getting anywhere" (Thelen, 1949).

This is a field so new that even the experts in group dynamics have little to say about how the transition from traditional to democratic methods can best be made. On the other hand, the mounting evidence in favor of group dynamics in education indicates the importance of making such a change.

PROPAGANDA AND ADVERTISING

In its concern with developing attitudes and values, education is a form of persuasion and may seem closely related to propaganda and advertising. But the attitudes and values with which education is concerned are those of our society as a whole, whereas those of the propagandist or advertiser are most often

those of a special interest. A more important difference is that education tries to develop the individual's ability to make judgments and solve problems independently; the propagandist and advertiser hope to make his judgments for him.

It is difficult to estimate just how much we are influenced by propaganda. Over two thirds of the editorial material printed in newspapers is prepared by press agents, publicists, and public relations experts to present their clients' cases to the public in a favorable light. Such "slanted" stories have a far greater influence upon public opinion and action than does paid advertising.

GENERAL PRINCIPLES OF PERSUASION

Research has established a number of principles governing the effectiveness of propaganda and has given scientific support to the socially obvious fact that it can be effective. Studies have shown that mass communications can change opinions even when the audience does not initially agree with the source (Kaufmann, 1953).

One-sided vs. two-sided arguments. Propaganda is often more effective than debate in changing attitudes, as shown by a recent study in which 815 college students were tested for their attitudes on the superiority of males and females in various activities and were then subjected to a variety of persuasive techniques (Jarrett and Sherriffs, 1953). Those who heard a strong, one-sided argument for the superiority of one sex showed greater change of attitude in favor of that sex than those who heard a debate presenting the advantages of both sexes. The latter group tended to intensify their original views.

Though debate may be less effective in changing attitudes than propaganda, there is evidence that propaganda is often most effective when it presents at least some arguments for the opposing side, thus giving an appearance of objectivity. This was brought out in a study aimed at understanding the basis of resistance to counterpropaganda.

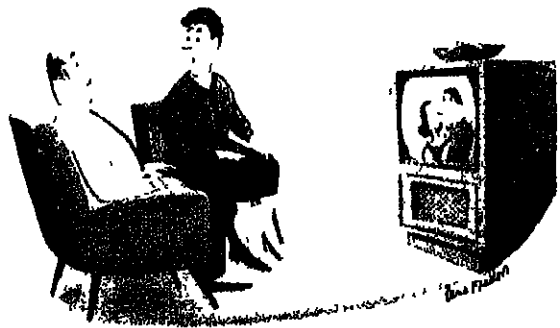
Four groups of high school students, each composed of several classrooms of social science students, listened to two versions of a recorded radio program. Half the students heard a one-sided version in which a commentator presented arguments

in support of the theory that it would be at least five years before the Russians could make atomic bombs in any quantity, because they did not have access to sufficient secrets, did not have enough uranium, and so forth. The other half heard the same commentary with the addition of a number of arguments in favor of more rapid production—presence of many able scientists, uranium mines located in Siberia, etc. The conclusion was the same, however; in fact, the one-sided talk was obtained by deleting from the recording the opposing arguments which appeared in the two-sided version.

A week later one of the groups which had heard the one-sided version and one which had heard the two-sided version listened to a "counterpropaganda" talk by a different commentator who argued that Russia probably already had A-bombs or at least would be producing them in large quantities in two years or less. This commentary was largely an elaboration of the opposition arguments of the two-sided original talk, although it contained some new material. It was essentially a one-sided presentation but included a few sentences mentioning and refuting arguments from the earlier communication.

At the close of the experiment all students filled out an opinion survey questionnaire which contained key questions about Russia's ability to produce bombs, the same questionnaire they had filled out several weeks before the experiment began. Results were compared to determine the extent to which opinion had shifted toward belief that it would take a longer period of time for quantities of bombs to be produced—the theme of the first propaganda communication. Among students who did not listen to the counterpropaganda, the amount of change in opinion was about the same for those who heard the one-sided lecture (64 per cent) as for those who heard the two-sided (69 per cent). Among those who did hear the counterpropaganda, however, the picture was entirely different. Those who heard the one-sided talk showed only a 2 per cent shift toward belief that a longer period of time would be required, indicating that the counterpropaganda had swayed them in the opposite direction. On the other hand, those who had heard the two-sided version of the first talk showed 61 per cent shift in opinion toward the belief presented first, indicating a high degree of resistance to the ideas presented in the counterpropaganda. A control group which heard no talks at all showed a change of 15 per cent toward belief in a longer period of time needed for bombs to be produced (Lumsdaine and Janis, 1953).

Apparently the person who is familiar with opposing arguments has an advance basis for withstanding the opposition.



"They must be using one of those hidden commercials I suddenly feel a terrible urge for something called O'Brien's Mustard Pickles."

Drawing by Dana Fraden,
© 1957 The New Yorker Magazine, Inc.

In an effort to increase sales, some advertising men have been experimenting recently with "invisible ads." These ads are based on the principle of subliminal perception—that our brains record many fleeting images of which we are not consciously aware. A message is repeatedly flashed on a motion picture screen, for example, at a speed so great that it cannot be consciously seen. The viewer is supposed to act on the message—that is, to buy the product advertised. Most psychologists believe that subliminal stimulation is a real effect but that until there has been further basic research, commercial applications are premature.

With people who are already convinced of the propagandist's viewpoint, however, a one-sided presentation is probably most effective in reinforcing the belief. This was brought out in an experiment which again showed the superiority of two-sided arguments for convincing people who are initially opposed to a point of view (Hovland, Lumsdaine, and Sheffield, 1949). Further research is needed on the kind and amount of opposing arguments which are most effective.

Appeal to fear. It has been found that appeal to fear is relatively ineffective as a persuasive device.

Three equivalent groups of high school students viewed different illustrated lectures on dental hygiene, each lecture having a different intensity of fear appeal. The group who viewed the minimum fear lecture showed the greatest degree of conformity to the lecturer's recommendations, as indicated by responses to a questionnaire on tooth-brushing practices. The group who viewed the lecture with the strongest appeal to fear showed no significant change. One week later a counterpropaganda lec-

ture, contradicting the original, was presented. The minimum fear group showed the greatest resistance to this counterpropaganda (Janis and Feshbach, 1953).

The investigators explained these results by saying that when too much fear is aroused by a communication, the emotional tension cannot be relieved by rehearsing the reassuring recommendations made in the communication, so the audience, to prevent further unpleasant emotion, ignores or minimizes the threat.

The "sleeping effect." Sometimes the effects of a propaganda communication will increase after a period of time, contrary to the normal expectation that the message would be forgotten. This effect, noticed in an experiment carried out by the Information and Education Division of the War Department, is known as the "sleeping effect" (Hovland, Lumsdaine, and Sheffield, 1949). It can be explained thus: Although the content of such a communication is learned well, the communication may be discounted as coming from a source with a propagandistic purpose. However, over a period of time the discounting factor tends to be forgotten more rapidly than the material itself, the net result being a delayed increase in the effect of the communication. Similar results were found to occur in an experiment in which a communication was given and later deliberately discounted by the experimenter (Weiss, 1953).

COMMON PERSUASIVE DEVICES

Propagandists and advertisers have developed a number of devices with which to

influence people to immediate action. They know that in general it is not good (from their point of view) to have people think too deeply about an issue.

Six common persuasive devices are *name calling*, *glittering generalities*, *transfer and testimony*, *plain folks*, *card stacking*, and *band wagon* (Miller, 1946). Another is the *appeal to prejudice*.

Name calling. Shakespeare overlooked the effectiveness of this device when he said that a rose by any other name would smell as sweet. A neutral object or person tends to become acceptable when given a pleasant name and unacceptable when given an unpleasant name. For example, when we refer to "John Doe, native son of the Golden West," most Californians will tend to feel favorably disposed toward this previously unknown person; but if we refer to the same native-born Californian as "a graduate of San Quentin," the effect is likely to be quite the reverse. Propagandists have rich vocabularies with which to describe persons, objects, or ideas, depending upon the interest they are serving and the effect they wish to create. The same individual may be described as *one hundred per cent American* or as an *isolationist*; as an *idealist* or an *impractical dreamer*; as an *enterprising businessman* or a *money-mad exploiter*.

Name calling does not always take the form of such obvious labeling. In everyday conversation we often choose between two words which mean about the same thing but differ greatly in attractiveness. In the two lists which follow, the terms are roughly

Old Title	Yearly Sales	New Title	Yearly Sales
Fleece of Gold	6,000	Quest for a Blonde Mistress	50,000
The Mystery of the Iron Mask	11,000	The Mystery of the Man in the Iron Mask	30,000
The King Enjoys Himself	8,000	The Lustful King Enjoys Himself	38,000
None Beneath the King	6,000	None Beneath the King Shall Enjoy This Woman	34,000
Ten O'Clock	2,000	What Art Should Mean to You	9,000
Pen, Pencil, and Poison	5,000	The Story of a Notorious Criminal	15,800
"Patent Medicine" and the Public Health	3,000	The Truth about "Patent Medicine"	10,000
Addison and His Times	0	London Life in Addison's Time	7,000
Art of Controversy	0	How to Argue Logically	30,000
Life of Tolstoy	2,500	Life of Tolstoy, Russian Novelist	6,500
Essay on Shelley	2,000	Shelley, Idealistic Dreamer	8,000
Casanova and His Loves	8,000	Casanova: History's Greatest Lover	22,000
Poems of Evolution	2,000	When You Were a Tadpole and I Was a Fish	7,000

In his book *First Hundred Million*, E. Haldeman-Julius told how he sold millions of copies of his "Little Blue Books." His success could be attributed in part to his practice of changing the titles of books which were not selling well. The effect on sales of some of these title changes is shown above (Haldeman-Julius, 1928).

synonymous, yet what a difference in their connotations!

later maturity	old age
slender	skinny
scent	stink
inexpensive	cheap
thrifty	stingy
earthy	dirty

The propagandist makes effective use of such emotionally toned words. We need to be especially on guard against such terms in news reports, since they can color our perceptions, and hence our judgments, without our realizing it.

In one experiment forty terms were selected from the columns of the *Chicago Tribune* and forty terms used in the same connection from the *New York Times*. Subjects were asked to mark for each term L (Like), D (Dislike), or ? (No feeling about it). A score was then computed for each term by subtracting the number of D's from the number of L's given it, dividing this by the number of subjects, and multiplying the decimal by one hundred. The chart at right shows some of the comparisons (Sargent, 1939).

Glittering generalities. When the political propagandist calls upon the voter to support "the man with a heart and the party with a soul," he is illustrating the technique of glittering generalities. When you encounter such slogans, ask yourself, "What does it mean? Could this same slogan be used with equal accuracy to describe the opposition? What are the facts?" If we cultivate the habit of looking beyond glittering generalities for the facts, we are not so apt to be surprised when the police arrest "Honest Jack, the customer's best friend" for selling stolen goods.

Transfer and testimony. The crux of transfer and testimony is the identification of a new object, idea, or personality with something venerated and respected. The picture of the all-American end lighting a cigarette of a particular brand makes hero-worshiping youngsters want not only to smoke but to smoke that particular brand. Candidates of both major political parties invariably display the American flag on the speaker's rostrum and quote liberally from Washington, Jefferson, and Lincoln. The trial lawyer for the defense might refer to a woman shoplifter's activities as: "This young mother's ill-advised

Comparison of Emotional Reactions of Sixty College Students to Various *Chicago Tribune* Terms and to Other Terms Used in the Same Connection by the *New York Times*

	score	difference
CT —radical	-53	
NYT—progressive	92	145
CT —government witch hunting	-38	
NYT—senate investigation	57	95
CT —regimentation	-53	
NYT—regulation	32	85
CT —Communist CIO leader	-68	
NYT—maritime leader	10	78
CT —labor agitator	-63	
NYT—labor organizer	12	75
CT —the dole	-35	
NYT—home relief	27	62
CT —farm dictatorship	-55	
NYT—crop control	-02	53
CT —loyal workers	60	
NYT—nonstrikers	08	52
CT —inquisitor	-22	
NYT—investigator	23	45
CT —CIO dictator	-72	
NYT—CIO chieftain	-33	39
CT —alien	-35	
NYT—foreign	0	35
CT —mass picketing	-55	
NYT—picketing	-50	5

but warm, human desire to put food into the mouth of her starving child."

When endorsement comes from a disfavored person or party, the effect of the endorsement is usually negative. In a California election campaign the *People's World*, a Communist paper, endorsed a certain pension plan. This fact was widely quoted by the opponents of the plan because most people have a tendency to be *against* anything the Communist Party is *for*.

In a nationwide study two logically equivalent questions were asked of strictly comparable groups. One group was asked, "Do you like the idea of having Thanksgiving a week earlier this year?" To

the other group the question was put, "Do you like President Roosevelt's idea of having Thanksgiving a week earlier this year?" Of the group answering the first question, 16.7 per cent replied "Yes"; of those answering the second question, 21.4 per cent gave a "Yes" reply. Apparently the existing general admiration for the late President influenced the responses of the second group in the direction of greater acceptance of the change (Roslow, Wulfbeck, and Corby, 1940).

Plain folks. This term covers a number of techniques whereby people are influenced into a certain line of action because it is identified with the "common man." Political candidates eat hamburgers, mow the lawn, milk cows, and engage in other simple, honest, respectable activities that are in no way related to the issues at hand. But such activities make the candidate seem "a regular fellow" and therefore more appealing to the average citizen.

Card stacking. A wide variety of warping and rigging of facts comes under this term. For example, a manufacturer of fountain pens might give every superior court judge in the United States a very fine fountain pen with his name on it and then have interviewers call on the judges to inquire what brand of fountain pen they used. In this purely hypothetical case the advertiser could claim: "With superior court judges, it's SCRATCHIO, ten to one." Here the cards have been so neatly stacked that nobody need lie.

As we have seen, there sometimes is propaganda value in not stacking the cards too well—in actually including a point or two on the other side.

Band wagon. Many people like to be on the winning side regardless of the merits of the issues or the tactics of the winner. This is the band wagon effect that advertisers take advantage of when they tell you of their product's popularity. Although people are influenced both by what "the majority" believes and by what "experts" believe, majority opinion seems to carry the greater weight.

Three hundred high school seniors, three hundred college seniors, and three hundred representative adults were asked to indicate their attitude toward seventy-five controversial questions concerning socio-economic problems touching on the fields of education, politics, and ethics. Such statements were included as, "The installment plan of buying has done

more harm than good to the stability of American economic life." On the first presentation subjects were asked to check "Yes," "Uncertain," or "No."

One month later one third of each of the three groups repeated the test with exactly the same conditions as on the first occasion, providing a control group. A second third of each group were this time given questionnaires in which the majority opinion for each statement had been circled in green. The remaining third of each group were given questionnaires in which expert opinion (the composite vote of twenty individuals from public life or university faculties) had been circled.

Both majority and expert opinion influenced the subjects in each age group, and in each case majority opinion was found to be the more effective of the two. The greatest influence shown was in the case of the high school students, where majority opinion was responsible for four times as many reversals of judgment as occurred in the control group, not subjected to social influence (Marple, 1933).

An interesting example of how card stacking can be used to produce a band wagon effect was seen in the employment of public opinion poll results in California in the 1956 presidential campaign (Palmer, 1956). In a front page story published just before the Republican Convention in San Francisco a political writer concluded:

"Nixon as President Eisenhower's running mate this year is preferred by 62.7% of all Republicans, Democrats and independents who said they plan to vote for President Eisenhower.

"Those preferring Gov. Herter represent a total of 24.4%."

The writer of the article went on to point out that 50.1 per cent of the registered voters who were willing to indicate an opinion expressed a preference for President Eisenhower and 32.7 per cent for Stevenson. But the article did not state how many of the voters who preferred presidential candidates *other* than Eisenhower were in favor of Nixon, so that actually there was no basis for computing Nixon's real popularity. If the reader stopped to analyze the figures given in the article—multiplying 50.1 per cent (the proportion of the total voting sample that favored Eisenhower) by 62.7 per cent (of those favoring Eisenhower who also favored Nixon)—he would find that 31.4 per cent was the minimum popularity figure for Nixon.

In this interesting example of card stacking the reader was left to guess (1) what proportion of people favoring candidates other than Eisenhower would have favored Nixon and, more important, (2) how many people in the state would have voted for the Stevenson-Kefauver combination against the Eisenhower-Nixon one. Although this article was factually correct, the facts were presented in such a way as to mislead the average reader as to the known extent of Nixon's popularity in California. We can only guess how much the publication of opinion poll results acts as a persuasive device in influencing public opinion, but there is little doubt that it can help create a band wagon effect.

Appeal to prejudice. One of the most potent techniques of the propagandist is that of appealing to prejudice. Interesting examples of the way that prejudice can influence our judgment were the reactions of voters to the issue of Eisenhower's health during the 1956 presidential campaign and to that of Roosevelt's health during the 1944 campaign. The Gallup poll showed that 70 per cent of Eisenhower voters thought that his health would be adequate to carry him throughout a campaign and a four-year term in office. Among Stevenson voters the trend was sharply reversed, with only 23 per cent thinking the President's health was adequate (Gallup, 1956).

Interestingly, similar figures were obtained from a poll reported on August 30, 1944, several months preceding the death of President Roosevelt. At this time 84 per cent of the Roosevelt voters thought that his health was adequate to carry him through another four years of office, as opposed to only 47 per cent by Dewey voters. In both these cases Republicans and Democrats had equal opportunity to read the newspapers, listen to the speeches, and draw their own conclusions. Obviously their judgments were influenced more by political prejudices than by facts.

Prejudiced individuals are more susceptible to types of propaganda fitting in with their beliefs, but they are almost impervious to propaganda which opposes their prejudices. Not only do they tend to avoid reading or listening to ideas contrary to their beliefs, but they may be so skilled at evading the impact of such material that they actually misinterpret its message (Cooper and Jahoda, 1954). In looking at cartoons designed to make the reader identify himself with the

prejudiced character and thus laugh at himself, the prejudiced person may identify momentarily—but then he immediately seeks some point of difference and concentrates upon it so much that he may miss the point of the cartoon entirely.

The prejudiced person may also miss the point of antiprejudice propaganda by changing its frame of reference. In the case of dramas or stories illustrating a principle, for example, he may accept the principle but make exceptions for himself or for the particular minority group presented. Thus, after reading a leaflet advocating tolerance for Jews and ending with the message, "Live and let live," prejudiced persons often commented, "But it's the Jews that don't let you live; they put themselves outside the rule." Or the prejudiced person may regard the particular incident depicted as a good story but not true to life. After hearing a broadcast entitled "Belgian Village," which told the story of a Jewish couple rescued from the Gestapo by villagers, listeners who had scored high on a conservative political attitude scale which has a high correlation with prejudice toward minority groups tended to discuss the program as an "adventure story" or "war story" and to ignore the special appeal for tolerance which had been presented along with it.

OBJECTIVES

OF EFFECTIVE ADVERTISING

Advertising is a process of producing and circulating organized stimuli through mass media—newspapers, magazines, billboards, radio, television, advertisements—in an effort to influence the buying behavior of potential customers. Although the advertiser's ultimate goal is maintaining or increasing sales, a good display advertisement or television commercial must accomplish four other objectives before it can be effective.

1. It must attract and hold attention.
2. It must deliver a sales message concerning the product and its advantages in a meaningful, believable manner.
3. It must convey favorable feelings toward the product advertised and/or the sponsor.
4. It must be remembered.

To a large extent these same objectives apply to the propagandist concerned with selling ideas rather than products.

"INSTITUTIONAL" ADVERTISING

In addition to extolling the virtues of their particular products, a number of businesses, chiefly large corporations, are making increasing use of "institutional advertising." This is really a form of propaganda designed to create a favorable attitude toward the company itself or toward business in general. It may employ a number of special advertising techniques (Pearlin and Rosenberg, 1952).

1. *Elaboration of latent consequences.* A commonly used technique of institutional advertising is to present corporation activities in such a way as to make them seem particularly beneficial to individuals, groups, or the nation as a whole. Bypassing the fact that profit is, after all, the primary objective of any business, these advertisements play up those activities of the company that are incidental to its pursuit of profit—providing employment for thousands of people, making a contribution to community resources, meeting the needs of some group, or even paying large taxes.

The beneficiary of corporation activity may be the individual—"Without railroads, you would not have your housing, your food, and countless other necessities and luxuries" (Association of American Railroads, 1950). Or the beneficiary may be some subgroup, such as the farmers. Even small business has been pointed out as benefiting from the operations of the big corporations. For example, Standard

Oil stated in a radio commercial: "It is a company practice to buy locally whenever practical. . . . Its shopping list exceeds fifty thousand items—goods and services like lumber, carpentry, shovels, paper, hose—everything it takes to keep a company like ours going. In totaling up the sales on these goods and services, the cash registers of thousands of local western business firms ring up more than one hundred million dollars every year! These are facts that explode an old myth to the effect that big business makes it tough for small business" (Standard Oil Company, 1950).

2. *Humanization.* The large corporation, which of necessity is impersonal, is often presented as if it were a warm-hearted individual—friendly, folksy, generous, solicitous, hard working, intelligent, and patriotic. "United States Steel *worked hard* in 1946 to supply as much as possible of the steel and other products and services the nation needed so badly . . . United States Steel has *always worked to the best of its ability* to meet the needs of our country" (United States Steel, 1947).

3. *Denial.* Big companies often use institutional advertising to deny such charges against them as monopoly, greed for profit, management by cliques, and other practices for which there is cultural distaste. For example: "United States Steel earned a profit of only five and a half per cent on its investment; or to put it another way, six cents on each sales dollar. This seems far from an excessive profit" (United States Steel, 1947). Or by *conversion* the company may make the very aspects which are distasteful to many people appear in a favorable light—only big companies can be efficient, and expansion (made possible by large profits) is an effort for the good of the nation.

4. *Creation of ego involvement.* Institutional advertising, as well as other propaganda efforts, tries to involve people personally in its cause. "You" or your local college or hospital may be a stockholder, so it is to your interest for the company to make profits. Or you may be taken "backstage" to see how the business operates and what its problems are so that you will develop a sympathetic interest in seeing them solved.

5. *Association or status contagion.* A company may try to obtain an aura of sanctity for itself by making verbal associations with such values as family life, religion, and free-

Frequency of Certain Appeals in
Institutional Advertising in
Selected Magazines in 1948

	Life	Fortune	Time	News- week	Saturday Evening Post	total
Freedom	16	18	33	49	13	129
Service	17	23	18	58	68	184
Progress	22	36	66	57	49	250
Prosperity	3	21	30	28	14	96
Equality	6	.	1	7
Protection	14	7	14	25	33	93
Local Pride	21	28	10	34	30	123
Tolerance	20	3	15	32	29	99
Efficiency	16	4	15	32	45	112
Inefficiency	4	4	5	2	3	18
Superiority	8	18	27	28	25	106
Inferiority	...	2	2	4
Patriotism	21	6	22	18	22	89

From Albis, 1956

There are numerous types of institutional ads, but the above examples show some of the methods used by advertisers to accomplish their main purpose—to give the reader a favorable impression of the company.

dom. The company may be presented as a family, too, working for freedom as everyone must. Since this device must assume that the public will make the desired association between the corporation and the value, it is not often used unless it can be directly tied in with incidental benefits of the company. For example, it may be pointed out that wages paid by the corporation make possible pleasant family life for the veteran or give him the chance to get ahead, which is part of his American heritage.

6. *Omissions.* Since institutional advertisements deal more with ideas than with products, many omissions are necessary to avoid hurting the feelings of some particular group. Organized labor and the government administration are almost never mentioned, nor are class or race distinctions. References are omitted not only to money-making as an objective but also to any bad incidental effects of "bigness," such as the possible effect of assembly line work on personality. Such omissions are really a form of card stacking.

MEASURING

GROUP OPINION

As we noted in Chapter 14, communication is a two-way process. Unless the *source* of information has some knowledge of how it is received at its *destination*, efforts to communicate cannot be very successful. In face-to-face contacts feedback is relatively simple and direct: we can judge the effect of what we say by our listener's facial expressions, his verbal responses, and his actions. In education, the teacher measures the effectiveness of his efforts to communicate knowledge and ideas and attitudes by evaluating the responses—changes in behavior—of his students. In most mass communications, however, the problem of feedback is much more complicated. How can a sponsor gauge the reaction of potential customers to his television commercials when he is addressing an audience of millions? How can the politician know, before the votes are counted, whether his efforts to persuade the public to his point of view have been successful?

As educators, advertisers, and propagandists have come to rely increasingly on mass communication media, they have had to develop improved techniques for measuring the reactions of large groups of people. Advertising research and public opinion polling both represent efforts to establish two-way communication. (See pages 551-555.)

TECHNIQUES

OF ADVERTISING RESEARCH

National advertisers spend large sums of money to increase or maintain the sales of their products. A two-page advertisement in color can cost over sixty thousand dollars to run once in a magazine of high circulation. This does not count the time required to prepare the copy and art work. Obviously, it is important to know in advance where the advertisement is likely to be effective. It can cost as much to run a poor advertisement as a good one.

Many psychologists are currently engaged in advertising research to protest the effectiveness of advertisements. This work breaks down into two basic phases: the *quantitative*, or "nose counting," phase and the *qualitative*, or "motivational research," phase.

Quantitative research. One kind of advertising research is concerned with collecting certain definite facts about the customers or potential customers of the product in question. For example, who buys the client's own or competing products? How can present customers be classified in terms of their age, income, sex, race, and education? What are the advertising media by which they are reached? And to what extent do they buy and how much are they willing to pay? The methods of quantitative research tell *who* and *how many* buy but not *why* they buy. Research of this nature has been standard practice for thirty years and does not require psychological training, although many trained psychologists are involved in this type of work.

A good example of quantitative research is seen in the following study of coffee drinking.

Since 1942 a certain market research organization has been making one or two surveys a year on "all types of beverages." These are called Beverage Biography Surveys and approximately twenty-five thousand persons are interviewed personally in each survey.

It was found in the 1949 survey that 96 per cent of all families drank some brand of coffee. In reply to the question, "What brand of coffee did you buy last (brand) _____ either regular _____ or instant _____ coffee?" a total of forty-two brands was named. This total included eight brands of instant coffee. This question was asked of ten thousand housewives. Maxwell House was mentioned by 15.2 per cent of the respondents. Folger followed in second place with 9.0 per cent. Eight O'Clock, Hills Brothers, and Chase and Sanborn followed in that order. Some brand of regular coffee was mentioned by 90 per cent of all respondents. Among users of instant coffee (6.1 per cent of all respondents), Nescafe was named most often.

The Beverage Biography Survey measures only the number of persons who use a particular brand of coffee, not the quantity of coffee sold or the motives determining the choice of customers. Nevertheless, it is possible to use the results of such research to draw certain tentative conclusions about why people choose one brand of coffee over another. One analyst interpreted the facts as follows.

With the exception of Eight O'Clock, all of the popular brands had about the same percentage of users in all income groups. Thus it could be concluded that "of all the factors influencing people to adopt a particular brand of coffee the price is probably the least important."

In addition, the survey revealed a preference for vacuum-packed coffee, probably because of the consumers' desire for better taste. Up to 1936, Chase and Sanborn more than any other coffee manufacturer had identified taste with freshness. Its slogan, "Look for the date on the can," was identified by more than 80 per cent of all respondents at that time. However, in 1936 Chase and Sanborn abandoned its vacuum tin for a paper package and cut the price by five cents a pound. Their sales went up immediately. But in the Chicago area, where for some reason the vacuum pack was retained, sales went up just as rapidly. The increase in sales was attributed by this analyst to the Major Bowes radio program rather than to the price cut. He felt that the change to the paper package, rather than improving the brand's overall position, had sacrificed Chase and Sanborn's claim to freshness and cost them the prestige they had built up over the years by identifying freshness with taste. This conclusion is supported by the fact that Chase and Sanborn's position in the industry began to decline steadily shortly after the change was made, until in 1949 only one person reported buying Chase and Sanborn for every three who bought Maxwell House. (In 1936 Chase and Sanborn led all producers.)

On the basis of the surveys it was concluded that quality of the product and the effective use of advertising—rather than price—are the chief reasons why one brand of coffee is preferred over others (Freiberg, 1950).

Qualitative or motivational research. The research departments of advertising agencies are very much concerned with studying the personality needs of large segments of the public, for they are finding that these are important determiners of buying behavior.

One successful advertising agency, for example, made a study in which people were asked how fast they would like to drive if they knew they would not be arrested. The owners of one expensive automobile of "flashy" design gave speeds that averaged 123 miles an hour. The owners of another expensive automobile of simple and conservative design gave answers that averaged 73 miles an hour.

People who have a strong drive for power are likely to want an automobile that "lets them leave the others behind." They want their automobile to be conspicuous and "flashy." If they have the money to buy the car of their choice they will probably buy the one that best meets their own personal needs. On the basis of motivational research such as that briefly described above, the copywriter can decide what to say and the artist what to illustrate in order to make a product appealing to potential buyers.

Another interesting example of motivational research was a study of consumer habits in buying beer and their reaction to beer advertising. The study was based upon three hundred psychological-depth interviews that sought to determine why and with whom people drink beer, when they do, and to discover which aspects of beer advertising cause them to switch brands.

Beer advertising, according to the study, should be directed primarily at the "middle majority group" which is not only the largest segment of the population but also the market in which more beer is consumed per capita. Responses of those who were interviewed showed that members of this middle majority group drink beer with friends as an "inexpensive, nonintoxicating drink which oils the wheels of socializing."

Most effective sales appeals emphasize beer as a refreshment at informal gatherings, after work or

exercise, at appropriate sports events, at lodge and holiday festivities, or with meals. The study recommended the portrayal of hearty, active men and wholesome "all-American" girls in modest, clean, casual surroundings. The "man of distinction" appeal is a poor one to use in selling beer (Anon., 1951).

In recent years psychologists and market research experts have come to question the value of direct questioning, even in depth interviews. Many consumer interviews now use indirect methods whereby the customer is asked to project himself into a situation.

One of the projective techniques is that used by Haire in his classic Nescafe instant coffee study: the shopping list.

The investigator first performed a conventional survey on attitudes toward instant coffee. He found that the bulk of unfavorable responses fell into the general area of "don't like the flavor," an easy, socially acceptable answer which gets rid of the interviewer. He then devised two shopping lists, identical in every respect except one: on one he had written, "Nescafe instant coffee" and on the other, "1 lb. Maxwell House Coffee (drip grind)." He then asked housewives to "project" themselves into the situation and characterize the women who bought the groceries. He found that the Nescafe purchaser was characterized as lazy, spendthrift, a poor wife and one who fails to plan well for her family (Haire, 1950).



Public opinion polls are a commonly used method of measuring the effect of mass communication. Usually the interviewers write down the answers, but in the special survey illustrated above, the interviewer used a tape recorder.

It is held by many that the projective technique is more natural and that it circumvents the desire of most people to give socially acceptable answers. Thus it may yield more valid information than the conventional interview—though considerable skill and experience are usually necessary to analyze its results. The various methods of quantitative and qualitative research all have their place in measuring consumer attitudes.

PUBLIC OPINION SURVEYS

Opinion polls are an important means for measuring the effects of mass communication on the general public or some particular segment of it. In recent years they have been used not only to anticipate election results but to measure public opinion and knowledge on all manner of topics. The demands for accurate measurement of public opinion have been so great that psychologists, statisticians, and other specialists have done considerable research on how best to plan and conduct opinion surveys. In this section we shall examine some of the problems involved in getting an accurate measure of what "the public" thinks, knows, feels, and does.

Sampling the population. The problem of obtaining a representative sample of the population is one of the most difficult in the whole field of measuring popular reactions. Each age, sex, income, religious, and ethnic group must be represented in accurate proportion if the survey is concerned with the public as a whole, as in the case of pre-election polls. The method used in obtaining a fair sample is a highly technical one and too complex for discussion here.

That the accuracy of public opinion surveys depends first of all on their sampling techniques was demonstrated fairly early in the history of wide-scale polling, during the 1936 presidential campaign between Roosevelt and Landon. The American Institute of Public Opinion, known as the Gallup poll, and the magazine *Fortune* were successful in predicting the outcome of the election whereas the *Literary Digest* was not. The explanation lies in the different sampling techniques used. The first error of the *Literary Digest* was to draw its sample from telephone and automobile owners, who are a relatively prosperous group in comparison with the population as a whole. Secondly, the *Literary Digest* conducted its survey by mailed questionnaires,

only a small proportion of which are ever returned. Furthermore, various studies have shown clearly that people who *do* answer and return mailed questionnaires are not typical of the total population (Calahan and Meier, 1939; Shuttleworth, 1940), so that the sample actually included in the *Literary Digest* poll was probably even less representative than that originally selected. The Gallup and *Fortune* polls, however, employed trained interviewers who talked personally with men and women of all social and economic classes.

The mere accumulation of large numbers of respondents will not compensate for bias in the sample. A straw vote of one million unrepresentative people will come no closer to representing the vote of the nation as a whole than a straw vote based on one hundred equally unrepresentative people.

Getting the truth. Another problem in opinion polling is that of framing the questions and asking them so that the respondent will answer truthfully and to the point. The technique of questioning is a subtle combination of art and science, but certain basic and tested rules should be followed. Knowledge of these will be helpful not only to the person conducting a poll himself but to anyone trying to evaluate poll results in magazines or newspapers. An analysis of the known principles about phrasing opinion questionnaires shows that there are four basic pitfalls to be avoided (Jenkins, 1941):

1. *Biasing or predetermining the answer.* Questions may be so worded as to suggest a particular answer which may or may not be the truth. Leading questions, such as "You are a Republican, aren't you?" are obviously defective. Answers also may be predetermined through the use of emotionally worded questions, such as one which was reported in an anti-organized-labor newspaper: "Do you approve the use of force, intimidation, and violence in coercing employees to join a labor union?" The fact that 99 per cent of the respondents said "No" probably means that they do not approve force, intimidation, and violence but tells us very little about whether they approve or disapprove of labor unions.

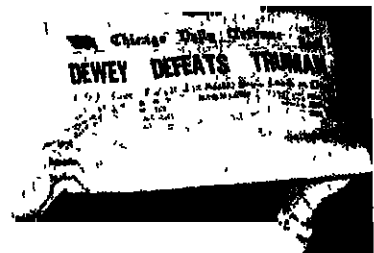
2. *Failing to determine sufficiently the direction of response.* Ambiguous, vague, or indefinite questions may elicit misleading answers or answers that resist analysis. For example, almost everyone would give an affirmative answer to the question, "Do you think that the most deserving people should

have a cut in taxes?" However, the definition of "deserving" would vary greatly from one person to another, so that the answers to this question would not cast much light on public opinion about desirable tax cuts.

3. *Exceeding the ability of the respondent to answer.* Sometimes questions are too difficult and technical for the respondent to answer. For example, a reasonable answer to the question, "How do you think depressions could be avoided?" would require more knowledge of economics and sociology than most people possess.

4. *Exceeding the willingness of the respondent to answer.* Most people will not give truthful answers to a question if their honesty will embarrass or incriminate them. Sometimes the respondent escapes embarrassment by lying; or he may simply refuse to answer. In the Gallup and *Fortune* polls of the 1940 presidential election, the Democratic vote in the South was appreciably overestimated, as was the Republican vote in the North. To some extent, these errors probably reflect the influence of social pressure and an unwillingness of many people to express their real opinions when they are different from the expected ones.

Accuracy of public opinion polls. By 1948 the American public had come to take public opinion polls for granted. The universal success of the nation's leading pollsters in predicting the outcomes of the presidential elections of 1936, 1940, and 1944 left most people with little doubt of their accuracy. It



In 1948 the assumption of a Republican victory in the presidential election was so strong—partly as the result of the forecasts of public opinion surveys—that at least one major newspaper, on the basis of incomplete and misleading election returns, released some papers with a headline announcing Truman's defeat.

was with considerable surprise, therefore, that people awoke on the morning following the 1948 election to discover that the polls had been wrong. The failure of the 1948 election surveys to predict Truman's victory over Dewey naturally raised the questions, "What went wrong? Just how accurate *are* the public opinion polls?"

Before considering why the 1948 presidential polls were wrong, it is well to consider how far they were wrong. The forecasts made by the nation's three leading polling agencies are shown in the table below, which compares the predictions with the actual returns.

Predictions and Actual Results
for the 1948 Presidential Election

Per cent of total presidential vote:				
	Truman	Dewey	Thurmond	Wallace
actual vote	49.5	45.1	2.4	2.4
predictions:				
Gallup poll	44.5	49.5	2.0	4.0
Roper poll	37.5	52.8	5.3	4.4
Crossley poll	45.0	50.1	1.6	3.3

It is obvious that all three major polls failed to predict the largest percentage of votes for the winning candidate. But although the results of the Roper poll were considerably divergent from the final returns, both the Gallup and Crossley polls predicted the Truman vote within 5 percentage points. In fact, in terms of percentage point predictions, both of these polls actually made smaller errors in 1948 than they did for the 1936 election, when the Gallup poll successfully predicted the outcome but missed the actual major party vote by 6.6 per cent. Statistically, most of the 1948 election polls were only slightly in error, but the closeness of the election made the error seem to be a glaring one.

Careful analysis of the methods used by the polling agencies has indicated that their failure to predict the 1948 election results was caused by (1) errors of sampling and interviewing and (2) errors of forecasting resulting from failure to evaluate properly the final decision of undecided voters and to consider last-minute shifts in voting intention (Mosteller *et al.*, 1949). The major sampling error committed by the polls was the failure to eliminate respondents who were not likely to vote. Since 1948 pollsters have paid greater

attention to the use of "screening" questions, to determine whether a respondent actually is eligible and intends to vote. Although the polls may question a cross section of socio-economic, age, and sex groups, these respondents may not represent the actual voting population unless they are screened on their intention to vote.

The circumstances of the 1948 election were such that many voters either remained undecided until just before the election or made last-minute shifts in voting intention. In order to prepare their final reports and publish their results before election day, the major polls made no attempt to detect shifts of opinion during the last two weeks of the campaign. Thus their final predictions reflected public opinion as it stood two or more weeks before the election rather than on election day. It was during this last two-week period that many voters finally decided how to vote or made a last-minute shift in opinion.

Predictions and Actual Results for the 1956
Presidential Election

Per cent of total presidential vote:		
	Eisenhower	Stevenson
actual vote	57.7	42.3
predictions:		
Gallup poll	59.5	40.5
Roper poll	57.0	38.0

Since the fiasco of 1948 public opinion polls have greatly improved their techniques and have gradually regained popular acceptance. In the 1956 election the Roper poll forecast Eisenhower's popular vote within 0.7 per cent; the Gallup poll missed by only 1.8 per cent. During recent years, opinion surveys have also been used with increasing success in market research and industrial relations.

S U M M A R Y

The enormous quantity of mass communication in America today may be divided into *mass education* on the one hand and *propaganda* and *advertising* on the other. All use the same media, and all attempt to persuade; but their ultimate aims are very different.

Education seeks to teach people to make judgments. Propaganda and advertising seek to make judgments for people.

There have been vast changes in the aims and methods of American education in the past few decades. Today, the best schools accept a broad view of education; they accept responsibility for helping young people develop the skills and understandings they will need as mature citizens. Building on the learner's own interests and needs, the modern teacher no longer merely transmits knowledge but instead fosters, guides, and identifies desirable behavior change. The modern classroom is a laboratory in which children practice the skills and techniques of living in a democratic society. They learn by doing, through both real and vicarious experience.

Allowing for individual differences is one major problem in the classroom. When children are grouped by ability, as they are in most modern classrooms, teachers must guard against creating feelings of high and low status. Another, broader problem is that of *curriculum design*. There are three basic plans: the *unstructured*, or child-centered; the *integrated*, or core; and the *subject*, or traditional. Each has its supporters, but in all three there is a general trend toward integrating subject areas with each other and with the child's out-of-school experiences. Most important is the selection of materials and learning experiences appropriate to the child's level of maturity. Today, there is increasing integration of opposing theories in education—including those of *progressives* and *traditionalists*.

Group dynamics as applied to education is called *participative action*. It represents group-centered, as opposed to teacher-centered, methods in the classroom. Some studies have indicated that students prefer the older, authoritarian approach, but the permissive approach has the advantage of offering valuable "incidental" learning. So far, learning through participative action remains in the experimental stage.

The tremendous influence of propaganda becomes apparent when we realize that two thirds of the editorial material in our newspapers is "slanted" by press agents and public relations men. Various principles of persuasion are recognized: the *one-sided argument* (effective with those in initial agreement), the *two-sided argument* (effective with those initially opposed); the *appeal to fear* (relatively ineffective); and the "*sleeper effect*" (in which a communication is first rejected as propaganda and later accepted as fact). Persuasive devices include *name calling*, *glittering generalities*, *transfer and testimony*, *plain folks*, *card stacking*, *band wagon*, and *appeal to prejudice*.

The effective advertisement must *attract and hold attention*, *deliver a sales message*, *convey favorable feelings*, and *be remembered*. Institutional advertising has its special techniques: *elaboration of latent consequences*, *humanization*, *denial and conversion*, *creation of ego involvement*, *association or status contagion*, and *omission*.

Like other forms of communication, mass communication requires feedback to function effectively. Advertisers tackle this complicated problem through *quantitative research* to find out who and how many buy a product and *qualitative* or *motivational research* to discover the personality needs that influence choice of one product over another. In the latter, the indirect methods of the *projective technique* have had good results.

Directors of *public opinion surveys* are faced with two basic problems: getting a representative sampling of the public and getting honest, direct answers from that sampling. They must avoid *biasing or predetermining an answer*, *failing to determine sufficiently the direction of response*, *exceeding the ability of the respondent to answer*, and *exceeding the willingness of the respondent to answer*. The accuracy of opinion polls has increased greatly in recent years, as predictions of the voting in presidential elections have revealed.

CHAPTER SEVENTEEN

PSYCHOLOGY



FINDING THE RIGHT JOB

FINDING THE RIGHT EMPLOYEE

THE UNDERSTANDING AND CONTROL
OF HUMAN RELATIONS

HUMAN FACTORS IN ENGINEERING
DESIGN

Today there is much concern over the roles that employers, labor unions, and government should play in deciding on wages, working conditions, and the right to hire or fire. Regardless of how these economic and political questions are finally resolved, there will continue to be certain problems in the area of employer-employee relationships that can be solved only by the application of sound principles of vocational and employment psychology. Although these problems are interrelated, they can be classified into four fairly distinct categories: (1) the employee's search for the right job; (2) the employer's search for the right employee; (3) the understanding and control of human relations in business and industry; and (4) consideration of the human factor in planning working conditions and in designing tools and equipment.

FINDING

THE RIGHT JOB

In the choice of a vocation certain important questions must be considered: *What does the job require* in terms of education, intelligence, special abilities, physical strength and endurance, and temperament and personality? *What satisfactions does the work give?* Do they coincide with the satisfactions required by one's particular interests? *What opportunities exist* in this occupational field and what do the trends for the future seem to be?

WHAT DOES THE JOB REQUIRE?

Any employment—whether it be practicing a learned profession, managing one's own business, or working for someone else—requires certain qualifications on the part of the individual. These are never quite the same for any two kinds of employment.

Education. For any job there are certain educational requirements. For some, a high school education is sufficient, whereas others demand a college degree—a bachelor's, a master's, or even a doctor's degree. Some jobs

also require specialized courses lasting from a few weeks to several months, sometimes even longer. It is always important to discover exactly how many years of training (including apprenticeship or internship) are required before well-paying work will be available. The individual who has such information can avoid wasting effort on a career that he might eventually have to give up as impracticable.

Intelligence. Numerous psychological surveys have shown a considerable relationship between an individual's level of "general intelligence" and his success in a particular occupation. The results of one such study were shown on page 96, where figures were given indicating both the mean intelligence test score for certain occupations and the amount a person's intelligence could deviate from the mean without seriously hampering his chances of success. A person may fail to make good in a particular occupation if his intelligence is either too low or too high for his job. In the first case he may commit errors because he has to make judgments too complex for his understanding; in the second case

he may soon become bored with the job's lack of challenge for him.

A convincing demonstration of the relationship between intelligence (as measured by a test) and boredom (as reported by the worker) is found in a study of 116 girls doing highly repetitive work in candy factories in England. The girls who reported themselves as most bored averaged higher in intelligence than did the girls who were less bored by their work (Wyatt, Langdon, and Stock, 1937).

The chances are that a person will be unable to do acceptable work in an occupation if his intelligence falls more than one standard deviation below the mean for that occupation. At the same time, he is likely to be restless in a low-level job if his intelligence is much higher than is typically found in that job. Fortunately, some jobs offer opportunities for work of almost unlimited complexity and interest. Law, medicine, or electronic engineering, for example, have no ceiling on possible intellectual activity. Persons of vastly superior intelligence will have no trouble using their abilities if they choose a suitable occupation and are sufficiently motivated.

Physical ability. Each job or occupation makes its own demands in regard to physique and health. For example, civil engineers, meteorologists, and geologists often work in extreme climates and bad weather. In choosing a vocation it is important to consider such requirements, so that you can select something in keeping with your own strength and endurance.

Special abilities. Most occupations require certain special abilities. The engineer must use complicated mathematics. The dentist and the surgeon need good vision and good motor coordination. The architect and the costume designer must be able to visualize spatial relationships. Standardized tests are available to measure many such special abilities.

Temperament. In many kinds of work the individual's temperament seems definitely related to his vocational success and satisfaction. For example, one study showed that graduate nurses were more socially introverted and less happy-go-lucky than the norm of college girls. However, the nurses were superior in factors relating to inferiority feelings, nervousness, depression, emotional stability, objectivity, agreeableness, and cooperativeness (Healy and Borg, 1951).

Salesmen, as a group, tend to be more extroverted than the general population (Husband, 1936). This is also true of others who deal with people in face-to-face situations, such as business executives, supervisors, policemen, and military officers.

Scientists, statisticians, engineers, draftsmen, inspectors, and others who work primarily with ideas and objects rather than with people tend to be introverted. This group would include bookkeepers and accountants—with the exception of public accountants, who must work with and keep the confidence of their clients and in that sense are "salesmen," just as doctors and dentists are.

"Social intelligence," or the ability to get along with people, is an important determiner of successful adjustment in many vocations. A basic characteristic of social intelligence is a ready awareness of the opinions, feelings, and values of the people with whom you are involved.

Interests. Your pattern of interests is another important factor to be considered in predicting your adjustment to any vocation. The *Strong Vocational Interest Blank*, if filled out honestly, is a good predictor of how much satisfaction you might actually find in the various occupations for which standards are available.

The long-term validity of the *Strong Vocational Interest Blank* was tested recently by checking the ratings made by sixty men during college against their vocational status thirteen years later.

The interest scores made by the men for the occupations they later chose were compared with the average interest scores made by all other men for those occupations. These data for six of the most commonly chosen occupations are shown below.

Occupation	Average Score of Men Engaged in Occupation	Average Score of All Other Men
physician (N=12)	42.3	32.8
lawyer (N=11)	40.6	30.5
public administrator (N=5)	45.8	39.6
engineer (N=4)	53.8	30.1
chemist (N=3)	45.0	33.2
minister (N=2)	44.0	29.2

It is notable that the two men who left the profession of medicine had made a mean score of only 35.5 for the medical vocation, and the three lawyers who left the profession of law had also had a lower mean score (33.0) than those who continued to practice. In most other cases, too, those who left a particular profession had lower interest scores than those who stayed in it. Furthermore, those whose interest scores were highest tended to be most happy in their work (McArthur, 1954).

Despite the close relationship between interests and vocational success, you cannot assume that your abilities will automatically parallel your interests, for studies have failed to show a high correlation between interests, intelligence, and special aptitudes (Wesley, Corey, and Stewart, 1950).

WHAT SATISFACTIONS

DOES THE WORK GIVE?

The successful person is usually one whose work brings him genuine satisfaction. Examine your motives critically and carefully; then try to find the work that offers rewards you consider really important. Ask yourself what satisfactions you require. What is your definition of success? Do you feel that the man who makes the most money is the most successful? Or the man who works the fewest hours? Is direct service to humanity an important goal for you? Do you require the respect, even the envy, of your fellows? Or can you be happy in doing what you like regardless of whether it brings prestige? For most individuals, personality needs seem to play a more important role in the choice of a vocation than do monetary considerations (Forer, 1953).

Most people are somewhat concerned with the degree of social approval given their work. An interesting study on this subject was conducted in 1925 and repeated in 1946 and 1957 (Counts, 1925; Deeg and Paterson, 1947; Ruch, 1957). College students were asked to rate the prestige of various occupations in rank order. The results are shown in the table at right.

Although people are usually influenced considerably by what other people think of their work and obtain satisfaction from knowing they are in a respected profession, there are other nonmaterial sources of job satisfaction besides this. The table on page 452 shows the degree of liking for their work typically

Comparison of Social Status Ranks of Twenty-Five Occupations

Occupations	Rank order 1925	Rank order 1946	Rank order 1957
banker	1	2.5	4
physician	2	1	1
lawyer	3	2.5	2
superintendent of schools	4	4	3
civil engineer	5	5	5
army captain	6	6	6
foreign missionary	7	7	7
elementary school teacher	8	8	8
farmer	9	12	12
machinist	10	9	15
traveling salesman	11	16	11
grocer	12	13	13
electrician	13	11	10
insurance agent	14	10	9
mail carrier	15	14	17
carpenter	16	15	14
soldier	17	19	16
plumber	18	17	18
motorman	19	18	20
barber	20	20	19
truck driver	21	21.5	21
coal miner	22	21.5	24
janitor	23	23	23
hod carrier	24	24	22
ditch digger	25	25	25

reported by members of eighteen of the occupational groups upon which the Strong Vocational Interest Blank was standardized. Note that life insurance salesmen rate very high in job satisfaction, even though their work is only average in prestige according to the above table (Harrell, 1949).

The motivational factors are very important in determining whether or not a person will succeed at a particular job, but they are not all-important; ability must also be right. It is futile to argue that motivation ("will-do") is more or less important than ability ("can-do") since one without the other is wasted.

WHAT OPPORTUNITIES EXIST?

Psychological principles have little bearing on the practical question of job opportunities, but obviously this is a question you should

Percentage of Like, Indifference, and Dislike
for Their Jobs of Eighteen Occupational Groups

Occupational group	Like	Indifferent	Dislike
artist	99	1	0
aviator	99	1	0
architect	97	2	1
chemist	96	2	2
life insurance salesman	96	3	1
advertiser	95	4	1
buyer	95	5	0
physician	95	3	2
dentist	94	4	2
musician	94	4	2
sales manager	93	5	2
certified public accountant	90	9	1
lawyer	90	9	1
farmer	87	8	5
carpenter	83	13	4
real estate salesman	81	15	4
printer	79	16	5
office clerk	39	40	21

answer before deciding on a vocational choice. In addition to investigating the number of opportunities that are currently available, you should also try to find out whether the occupation you are considering is expanding or shrinking in the numbers it employs. The chart on page 453 shows recent employment trends for both men and women engaged in various professions and occupations according to United States census figures. In general, an upward trend in employment means an increase in job opportunities and a downward trend the reverse. In order to estimate future trends in employment as accurately as possible, however, it is wise to investigate all of the possible reasons behind shifting employment figures.

Recently there has been some fear that the trend toward "automation" (the control of machines by machines) will decrease job opportunities in many areas.

A special survey of 1574 companies—more than one fifth of which were already using automatic loading, transfer, or assembly machinery—found that this is not necessarily the case. Twenty-six per cent of the companies reported increased employment averaging 21 per cent, and 51 per cent of the companies reported no change in total employment. Only 23 per cent reported decreases (McGraw-Hill Department of Economics, 1957).

Many psychology students will be interested in the increasing number of opportunities available for those with advanced training in psychology. Some of the many careers in this field are discussed in a special chapter in the Reference Manual (pages 506-525).

FINDING

THE RIGHT EMPLOYEE

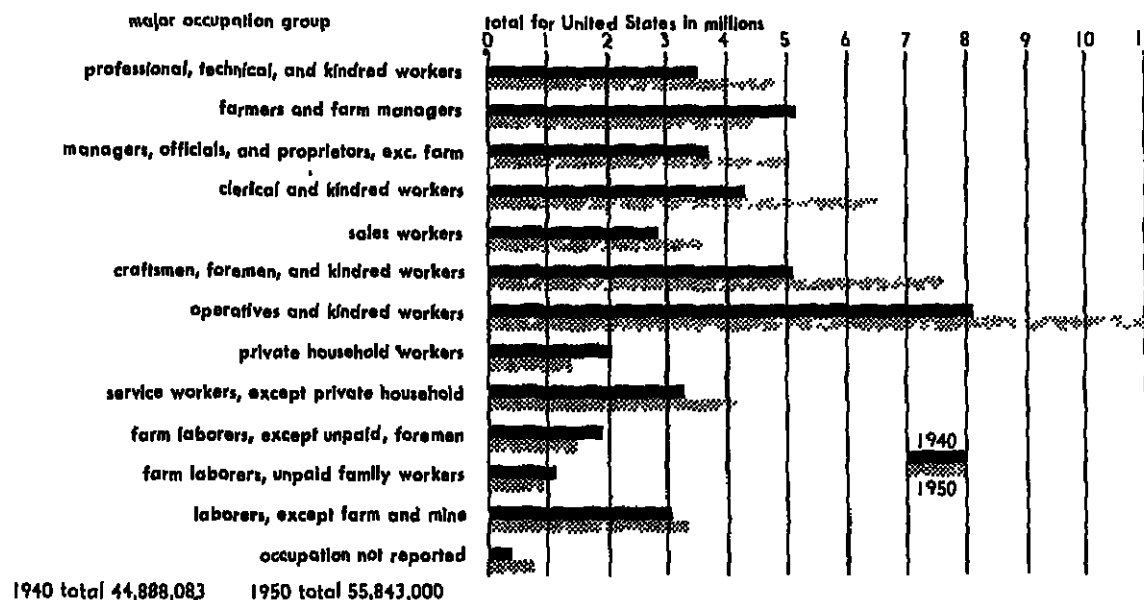
In the days of craftsmanship, before the industrial revolution, the owner of the shop performed all of the necessary functions of management. He bought his materials, hired his help, sold his goods, and worked with his own hands the rest of the time. Today specialization is the rule in most companies, and a personnel department has taken over the recruitment and hiring of employees. This section will examine the uses of psychology in personnel work.

REASONS FOR EFFICIENT PERSONNEL SELECTION

When personnel are selected carelessly, both employer and employees pay the cost. Whether an inefficient worker is kept on or is eventually replaced, the employer loses valuable time as well as money. The misfit employee, for his part, suffers discouragement and unhappiness over his work. Sooner or later he may get a transfer or decide to quit altogether, but in the meanwhile he has wasted time that he could have used more profitably. Efficient personnel selection, on the other hand, can bring important benefits to everyone involved.

Preventing excessive turnover. Excessive turnover of personnel is usually costly. The cost of hiring and training a new worker in industry is usually much greater than the cost of the training procedure alone, for a new person is likely to damage equipment, waste material, or even suffer serious and costly accidents. His production record at the outset will be poorer than that of the experienced worker. If the personnel turnover (*termination rate*) is much greater in a particular company than it is in similar companies or plants in the same community, the fault may

Employment in Various Occupations



bo either with the management's methods of selecting personnel or with its failure to see that employee needs are satisfied.

Preventing excessive absenteeism. Most experts agree that 8 per cent absenteeism—missing one day in every thirty-three working days—is a reasonable standard. A higher rate usually indicates that something is wrong. An important cause of absenteeism is management's failure to fit the right worker to the right job. Termination rate and absenteeism are the most obvious indicators of how well employees are adjusted to their jobs.

Increasing efficiency. Efficiency can be measured as *units of work performed per unit of time*. The worker who has been carefully selected for his job will often produce more than twice as much as the worker who is poorly suited to his job.

Preventing accidents and spoilage. When personnel are properly selected, accidents, spoiled work, and operating costs are decreased. Both accidents and spoilage reflect that those involved have poor aptitude for their jobs.

SELECTING EMPLOYEES WITHOUT USING TESTS

Despite the rapid advances in the field of psychological testing, as applied to the selection of employees in business and industry,

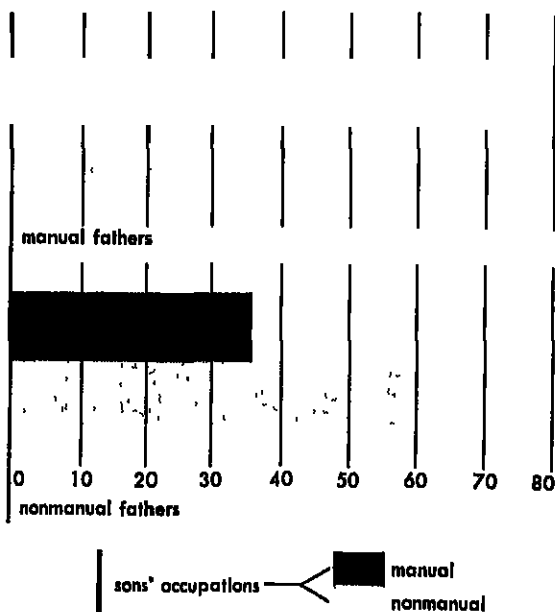
the personal interview (page 76) is still the most frequently used method of selecting employees. Information gathered in the interview is often supplemented by letters of application and letters of recommendation.

Letters of application. The letter of application has only limited value as a means of judging the fitness of an individual for a particular job. The information it includes is often very general and tells little of the applicant's capacity to do the work required. The prospective employer has no assurance even that the letter was actually written by the applicant. Nevertheless, many employers still require letters of application, and as a serious applicant you should learn to write a good one. It is customary to enclose a complete and accurate record of your past employment, together with a list of personal and business references. According to a recent survey, about 82 per cent of employment offices still require a list of references from nonrelatives of the applicant.

Letters of recommendation. Letters of recommendation cannot always be taken at face value. A past or current employer, for example, is not an unprejudiced source of information. A current employer may write a falsely enthusiastic letter about an unsatisfactory employee in the hope that he will change jobs. Conversely, an employer who wants to retain an able employee may write a less

Relationship of Son's Occupations (Manual or Nonmanual) and Fathers' Occupations

One of the most comprehensive studies of whether sons tend to follow the same occupations as their fathers utilized data from census interviews with over eight thousand heads of households in six major cities. As shown at right, a great majority of sons entered the same general category—manual or nonmanual work—as their fathers. Over 71 per cent of manual workers' sons entered manual work, and over 63 per cent of nonmanual workers' sons entered nonmanual occupations. In five occupational groups—professional workers, proprietors and managers, clerical workers, craftsmen, and operative workers—more sons followed their fathers' occupations than any other occupation; percentages ranged from 24 per cent for clerical workers to 33 per cent of operative workers. In other occupational groups, in which sons did not follow their fathers' occupations to such a great extent, those who entered a different line of work moved up in the social scale. For example, 34 per cent of sons of unskilled workers entered operative work, and 22 per cent entered craft work.



(Jenson and Kirchner, 1955)

favorable recommendation than the employee actually deserves. Employees and friends alike are prejudiced by their personal relationships with the applicant and, in general, hesitate to mention characteristics that might prevent the applicant from getting the job he wants. Still another weakness of the letter of recommendation is that the writer is often too busy to dig out the records necessary for making an accurate report of the applicant's performance.

Photographs. Even trained personnel workers cannot accurately judge the likelihood of an applicant's success or failure from a photograph.

Two psychologists went through the autobiographical sketches of the graduates of a large university. These had been published in connection with a class reunion. The alumni publication contained, in addition to the biographical material, two photographs of each individual—one taken at the time of graduation and the other at the time of a class reunion twenty-five years later. From the autobiographies—which set forth the various accomplishments of each alumnus in minute detail—the psychologists were able to select five successful and five unsuccessful men each in the professions of law, medicine, education, and engineering (Landis and Phelps, 1928).

Two other psychologists projected the photographs of these men on a screen and asked judges to pick out the pictures of the successful and the unsuccessful men. Two groups of judges were used—college students and trained personnel workers. By chance the judges would be correct in about 50 per cent of their choices. The table below shows that their judgments were no better than chance (Viteles, 1932)

Judgment of Success and Failure by Photographs

Judges	Per cent of young judged correctly	Per cent of middle-aged judged correctly
college students	47.3	51.3
personnel workers	52.2	52.8

PSYCHOLOGICAL TESTS

FOR HIRING

During the past twenty-five years many industrial organizations have found that psychological tests, conducted by experts, can contribute enormously to the efficiency of personnel selection. Workers also like to be tested. They feel more secure in their jobs when they know that tests have been used to match their abilities to the job requirements.

In a recent study 575 employees in eight organizations were polled by an anonymous questionnaire on their attitude toward taking employment tests. Sixty-seven per cent reported that tests were of value to themselves as well as to management; only one out of five thought they were beneficial only to management (Van Zelst, Kroh, and Kerr, 1951).

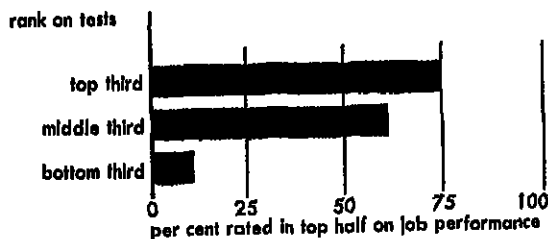
Psychological tests and employee desirability. The fact that adequate tests are very helpful in selecting the best workers for a job has been proved in a vast number of studies. In a recent one, tests for oil company technicians were developed and administered to already employed technicians to determine how well the tests correlated with actual job performance.

Each technician was rated independently by his two most immediate supervisors before any test scores were released. Technicians who made high scores on the tests tended to be rated high on job performance. In fact, 75 per cent of those who scored in the top third on the tests were rated in the top half on job performance, as compared to only 11 per cent of those who scored in the bottom third on tests. These results are shown in the graph below (Altman, 1954).

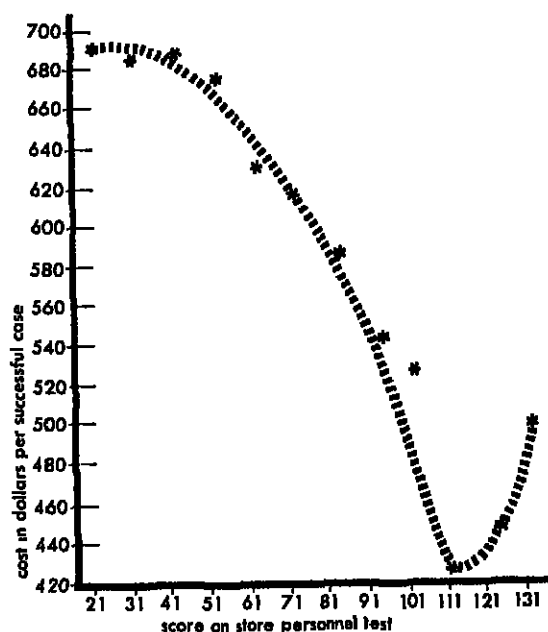
By eliminating those who are likely to be unsuccessful before starting to train them, management can save many useless expenditures. This is illustrated in the curve at right, showing the cost of training checkers in a food store chain. As compared with a testing cost of two dollars each, the wasted training cost of unsatisfactory checkers is high indeed (Doppelt and Bennett, 1953).

On the basis of the information pictured in a graph such as this, the employer can decide upon a "cutoff score," or minimum acceptable score, and then hire only those who make

Relationship of Test Scores to Job Performance



Cost of Training Satisfactory Checkers in a Food Store Chain



that score or better. However, he can seldom set the cutoff score at the point where the lowest cost per successful employee occurs. For example, if the food store chain had set its cutoff score at this point—111 as shown on the graph—it would have had to test 1440 people in order to obtain the required 108 successful employees. A lower cutoff score, between 91 and 100, would require the testing of fewer people and would still be reasonably efficient. You will notice that the curve goes up again after the score of 111 is reached. This is because cutoff scores higher than that would require the testing of so many persons that the total cost would be increased.

Unfortunately, no testing program can be perfect. Some potentially superior employees will be rejected by any test standard, and some potentially inferior ones will be passed by the same standard. The objective is to reduce the proportion of inferior who pass and to increase the proportion of superior.

Employees who test high on pre-hiring tests generally accomplish more on the job. When this factor is added to that of a lowered turnover rate, the total savings to management from careful employee selection by tests are very substantial.

The use of tests in personnel selection has gained considerable impetus since World War II, when the armed forces made great use of testing procedures in selecting service personnel. The Air Force, in particular, became noted for the speed, economy, and efficiency with which they were able to select and train a vast body of men and put them into the field. Over a period of four years approximately 1,500,000 cadets were tested at an average cost per man of five dollars. The savings in training costs made possible by the Air Force's extensive testing program ran into the billions of dollars. It is impossible to estimate the number of lives saved by selecting pilots, navigators, and bombardiers who were well suited to their jobs and could be made ready for active service in a minimum of time.

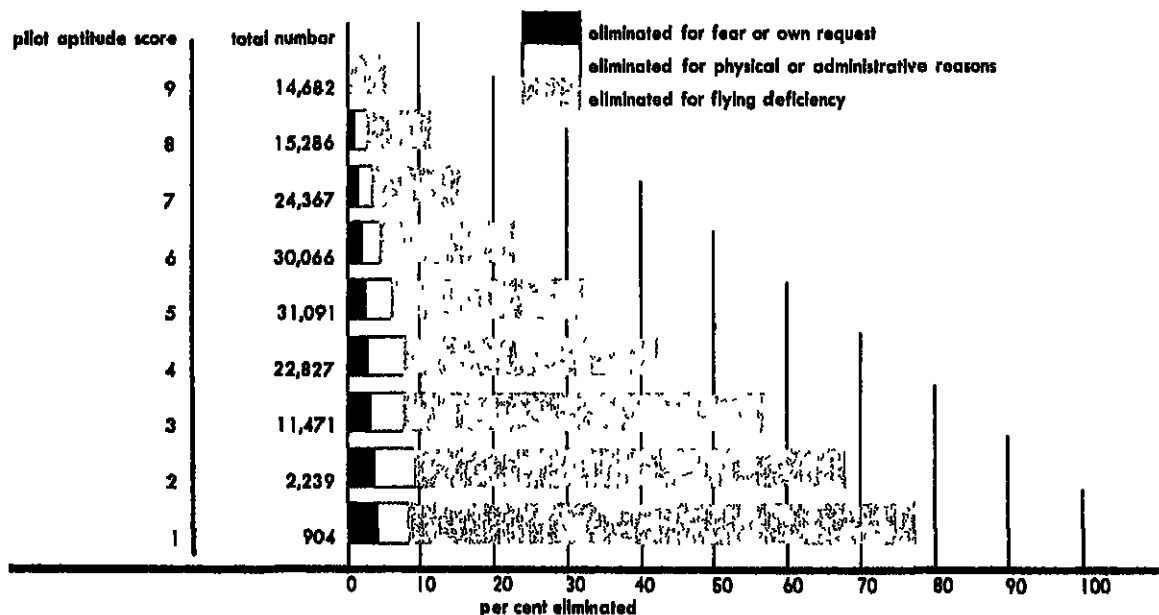
Other branches of the service also took advantage of testing procedures, with comparable results. Although industry has been slower in developing testing programs, since the war an increasing number of private enterprises have come to rely upon such scientific methods for selecting personnel.

Methods of establishing a testing program. To become an expert in employee testing requires several years of graduate training and supervised practical work. Obviously this highly technical subject can be presented here only briefly.

The surest way to set up a valid testing program is to "test the tests" in the situations for which they are intended. This procedure involves six critical steps:

1. Establish criteria of proficiency in performing the job for which selection of applicants is intended. If such criteria cannot be developed, it will probably be necessary to abandon the testing venture.
2. Analyze the job to determine which testable abilities and temperamental and motivational characteristics seem to be required in its successful performance.
3. Select tests that measure these abilities and traits. Administer the battery of tests to a group of applicants but do not consider the test scores in hiring.
4. Check each test to see if it has really differentiated between the successful and unsuccessful applicants. This step must wait until enough time has elapsed for supervisors to evaluate the work of the tested and hired employees according to the criteria set up in step 1. Tests that do not show a difference in average scores between successful and unsuccessful workers should be dropped from the battery.
5. Establish job ability standards or profiles in terms of the test scores. The standard may be, for example, that only applicants scoring above average on each of the tests found to differentiate between good and poor workers should be hired.
6. Continue testing all new applicants, but now employ only those who meet the established standards.

Relation Between Elimination Rate and Pilot Aptitude Score



Another variation of this method uses present employees instead of applicants in establishing the required standards on tests. The disadvantages of this practice are (1) present employees are differently motivated than applicants; (2) present employees vary much more in age and experience than youthful applicants; and (3) older employees tend to be rated by their supervisors as better than they really are merely because they have "been around so long."

With high-level jobs it usually becomes increasingly difficult to establish definite and objective criteria of successful performance. In such cases the psychologist must rely to a greater or lesser extent on *clinical insight* in setting standards.

Personality inventories. As adequate tests have been developed for measuring job knowledge and aptitude, it has become increasingly apparent that the subjective factors of personality and temperament are also important in personnel selection. Many well-trained workers with high aptitude for their jobs nevertheless fail to make successful employees. Some become dissatisfied and quit. Others are habitual trouble-makers.

Because self-inventories of personality and temperament have proven very useful in clinical situations, efforts have been made recently to adapt them to employment work. The chief disadvantage of the self-inventory as a method of screening job applicants is that most applicants tend to make the "right" responses rather than to evaluate themselves honestly (Ellis and Conrad, 1948). Whereas most people who come to psychological clinics realize that they must be truthful in order to receive help, the job applicant has a strong incentive to make himself look as good as possible. Several studies have failed to establish that various conventional self-inventories can predict success on the job (Harrell, 1949; Viteles, 1945).

Psychologists concerned with this problem have worked at developing ways to detect or prevent the faking of scores on self-inventories. One line of attack has been to work out "lie detector" scales. (Humm and Wadsworth, 1935; Ruch, 1942; Hathaway and McKinley, 1943). The principal limitation of this approach is that it provides no way of telling what the score would have been if the subject had not faked. Thus it still fails to accomplish the employer's purpose.

Another approach has been to develop correction factors which will adjust the obtained score on the basis of how many "good" points were won by faking (Ruch, 1942; Meehl and Hathaway, 1946; Jacobs and Schlaff, 1955). This approach has not been adequately investigated to determine what effect such a correction factor might have in increasing the predictive value of self-inventories.

The ideal way to control faking in self-inventories is to create tests that cannot be faked in the first place. One of the most successful ways of doing this is the "forced-choice method," as in the *Gordon Personal Profile* (Gordon, 1951). In this method items are arranged in groups of four, and the subject is asked to choose the item that is most like him and also the one least like him. A sample group follows:

A good mixer socially
Gives in readily to other people's wishes
Thorough in any work undertaken
Worries about possible misfortunes

When the forced-choice groups are made up, pairs of low preference items from two factors are put with pairs of high preference items from two other factors in the test. (High or low preference is previously determined by tallying the frequency with which other subjects marked each item as applying to themselves when taking the test as a straight questionnaire.)

The individual who is "out to beat the test" will select high preference items as most descriptive of himself and low preference items as least descriptive. This tends to move his score toward an average level and thus defeats his purpose.

The forced-choice test has proven uniformly superior to the straight questionnaire in accurately measuring personality and temperament traits.

The Gordon Personal Profile was given twice to a group of eighty-one students in different simulated situations. The first time the subjects were to pretend they were trying to get a job they very much wanted. The second time they were to pretend they were at a vocational guidance bureau taking the test to help in deciding on a vocational choice. On each scale of the test the students tended to show themselves in a slightly more favorable light when supposedly applying for a job, but only on the responsibility scale

was the difference significant. In general, the results indicated that the students had not changed their responses very much, showing that the Gordon profile is less subject to faking than the usual self-inventories (Rusmore, 1956).

Another recently developed personality inventory, the *Edwards Personality Preference Schedule*, seems relatively immune to faking. Realizing that people tend to choose socially desirable characteristics when describing themselves, Edwards designed this test in such a way that subjects must choose between two statements that are matched for social desirability. The 225 pairs of statements measure a number of personality needs, including achievement, deference, dominance, endurance, heterosexuality, aggression, and others.

This test was administered to twenty-five student nurses and later to twenty-seven affiliate nurses. A month later the same subjects were given a list of the names and definitions of the needs measured by the test. They were asked to rank these needs in order from most to least characteristic of themselves and then from most to least socially desirable. These rankings correlated .90 with each other, but neither showed a positive correlation with the raw-score ranking of the actual needs of the nurses, as determined by the Edwards test. If the test had been faked, correlation between the rankings and the raw scores should have been high (Navran and Stauffer, 1954).

Since this personality inventory has largely eliminated the influence of social desirability in its items, it may well prove to be a valid test of personality needs.

Situational tests. Situational tests are sometimes used to measure important personality traits which are very complex or not well defined, or to determine the relative effectiveness in a given job of individuals who may have made similar scores on written tests (Fiske, 1954). The applicant is placed in a situation as much like actual work conditions as possible, and his behavior is observed. The test should be devised to measure the employee's typical performance on the job and should involve only aspects of performance necessary for job success (Weislogel and Schwarz, 1955).

Situational tests have a number of drawbacks. Often it is very difficult or impossible to duplicate certain working conditions. Thus it would be impractical to determine by this

method how a worker would act in emergency situations or under extreme stress. If too many problems are included, involving different kinds of equipment, the test will be time-consuming and costly. Therefore, the most economical test will include only a few problems, each containing a maximum number of critical situations.

Another disadvantage of situational tests is that the observation and scoring of them involve all the problems of the rating process (page 74). In group tests especially, the more verbal applicant may show up to advantage when actually he is doing no more than the others. To avoid some of these scoring difficulties, many situational tests are devised so that the observer has merely to record whether a desired behavior did or did not occur.

Since there are so many problems involved in constructing and using situational tests—particularly in scoring them objectively—there is a good deal of disagreement among psychologists as to their value. Some hope that the situational test will become more standardized and prove to be a valid measure of attitudes, motivation, and other personality factors. Others regard the situational test as a temporary measure for use in areas where valid objective tests have not yet been developed (Flanagan, 1954; Fiske, 1954). Further research is necessary before the value of this method of employee selection can be established.

THE STANDARDIZED APPLICATION BLANK

In recent years the practice of using a *standardized application blank* or *biographical inventory* has become prevalent. Many application blanks, unfortunately, are limited in their usefulness because the items are more the product of hunch and inspiration than of careful analytic study. All too often the questions reflect some misconception of bygone management.

It is possible, however, to subject the items in an application blank to rigid analysis. For each item the question should be asked: Does this particular item actually serve to differentiate the successful worker from the unsuccessful one?

Let us examine a typical study of the predictive value of items in one application blank (Russell and Cope, 1925; Phoenix

Mutual Life Insurance Company, 1937). The purpose of the application blank was to select successful life insurance salesmen. When it was found that a certain answer to a particular question was given more frequently by the successful than by the unsuccessful salesmen, that question was given a positive weight. When it was found that an item was answered in a certain way more often by the unsuccessful than by the successful salesman, that answer was given a negative weight. It was thus possible to assign weights to each answer for each item in the application blank, so that the more valuable test items would count more in the total score.

The correlation between the total score for each salesman, arrived at by combining the various weighted answers, and the amount of insurance actually sold was so high that further research was done to improve the value of the application blank as a means of hiring. Success was defined as the amount of insurance sold during a beginner's first year and the persistence of each man in his work, as measured by the number of years he stayed with the company. The following information, gathered from items frequently included in application blanks, was valuable in selecting successful insurance salesmen:

1. It was found that married men made better life insurance salesmen than unmarried men of the same age. Furthermore, the married man with a few children was a better salesman of insurance than the married man with no children.
2. The applicant's educational level was found to be an important factor.
3. The higher the applicant's previous income, the more likely he was to become a successful insurance salesman.
4. The more insurance the individual carried himself, the more likely he was to be successful as a life insurance salesman.
5. Previous occupation bore an important relationship to success as a salesman. Men with previous selling experience were, as a group, more successful than men who had had other previous experience.
6. The longer the applicant's residence in the community, the greater his likelihood of success in selling insurance.
7. Membership in organizations such as lodges, fraternities, and so on, went with success in selling insurance.

An accurate method of weighting items in application blanks for insurance salesmen

has been developed by the Life Insurance Sales Research Bureau. The predictive value of this weighted questionnaire is indicated by the fact that men who get an A rating sell three times as much insurance during their first two years on the job as men who receive an E rating.

The standardized application blank has been particularly valuable in predicting stability on the job (Stockford, 1944; Palmer, Purpus, and Stockford, 1944). The main reason for its superiority over the self-inventory is that the applicant *knows* the answers to the questions and must answer them honestly, since the truthfulness of his responses can be checked by the prospective employer. This largely eliminates the possibility of faking.

THE STANDARDIZED INTERVIEW

The strength and weaknesses of the personal interview method in diagnosing human personality were reviewed in an earlier chapter (page 76). Experience in industry is showing that a carefully *standardized* personal interview, however, can be extremely effective as a selection device.

The standardized interview closely resembles the standardized application blank, except that the information is taken in a personal interview. The interview is designed to bring out data relevant to the following points: (a) the applicant's work record, (b) his schooling, (c) his early home environment, (d) his present domestic situation, and (e) his health. A skillful interviewer, following an established pattern, is able to draw from the applicant many personal details that would not be given on a printed form (McMurry, 1945).

In one study investigators found a correlation coefficient of .68 between employees' scores on a standardized interview (conducted at the time of hiring) and their success-on-the-job ratings (made later by their supervisors). Equally good results were obtained when predicting stability on the job as measured by length of employment before termination (McMurry and Johnson, 1945).

Similar results were obtained in a more recent study in which the patterned interview was used with young employees, aged sixteen to twenty-one, engaged in various types of routine manual work at a pharmaceutical manufacturing firm.

The interview was designed to cover six major factors—formulation of goal, strength of job interest, strength of general interests, self-regard, acquisitive perseverance, and nervous tension. In three of the five groups interviewed, the scores of the interview as a whole correlated significantly with supervisors' ratings.

When the separate sections of the interview were correlated with supervisors' ratings, those involving attitudes related to goal formation, general interests, and self-regard proved to be significant. The general conclusion was that a patterned interview of this type, designed to measure dynamic constellations of traits rather than isolated traits, can play a reliable part in assessing an individual's ability (Yonge, 1956).

This type of patterned interview provides a standardized situation for all applicants and still leaves the applicant a great deal of freedom to select and volunteer information (Whitlock, 1955). It does much to avoid the halo effect and other common pitfalls of the interview method.

The efficient personnel or employment office uses the standardized interview as one of several methods for selecting new employees. The best procedure in most cases is to use a standardized application blank first and then psychological tests to screen out those applicants who definitely do not qualify for the job. Those who qualify on the basis of this preliminary testing may then be given a standardized personal interview, as well as further tests if necessary. The preliminary screening process reduces the amount of time and expense wasted on interviewing unsuitable applicants. At the same time it makes possible a very careful interviewing of the most promising candidates.

HIRING THE OLDER WORKER

By 1960 there will be about fifty million people in the United States over forty-five years old; almost a third of these will be over sixty-five (Bowers, 1952). If present retirement policy continues until 1960, every thousand economically productive persons between the ages of twenty and sixty-four will be supporting from 165 to 169 dependent or partially dependent persons of sixty-five or over (Shryock, 1950). Not only does this put a substantial burden on the younger part of

our population, but many "retired" people want to continue working and are happier and healthier doing so.

If business and industry attempt to remedy this situation by making greater use of older workers, will production suffer? Most studies indicate that it will not, provided older workers are skillfully placed so they can make the most of their potentialities.

Age changes in psychomotor capacities. It is true, as we have seen, that many psychomotor capacities decline with age. After middle age the individual usually has a noticeably slower reaction time (Obrist, 1953). Muscular strength, including strength of hand grip, declines after the late twenties, usually at a progressively increasing rate (Fisher and Birren, 1947). In earlier chapters we have noted various changes in sensory capacities and intellectual ability—some of them representing improvement, however, rather than decline (see page 118).

A series of British studies has shed light on the entire question of psychomotor capacity and performance in older people.

One study showed that perceptual organization in complex activities tended to become less efficient with age but that once the perceptual data were organized the required muscular skill could readily be performed. Although some aspects of a complex activity showed deterioration with age, others seemed to improve in a compensatory manner, so that total performance often remained about the same (Welford, 1951).

Another study in the same research project dealt with jobs in which age difficulties appeared. The aged experienced difficulty in acquiring new job skills, especially when time stress was involved. This included time pressure, or constant pressure for speed of operation, and pacing, such as occurs in assembly line work. Age difficulties also appeared at a relatively early age when fine skills were required, as in discriminating between very small parts. Usually the elderly workers had little difficulty in the continued performance of a well-learned routine—although, again, they were unable to hold up well under time stress and found it difficult to continue in jobs which required continuous, vigorous physical activity (Belbin, 1953).

These studies suggest that in hiring the older worker the employer must take special

care to fit the worker to his job. But if he does so, he will have a valuable employee. Let us examine the evidence.

Job performance of older workers. Various investigations have indicated the special value of older workers. One study of 3162 workers—aged eighteen to seventy-six and ranging in duties from foremen and minor executives to unskilled laborers—revealed relatively small age differences in such traits as job knowledge, dependability, and accuracy.

Data for this study were obtained from comprehensive personnel records, including appraisals by foremen. In general, older workers were reported to be somewhat slower and to learn less readily but were rated higher on good attendance, steadiness, and conscientiousness. On ratings for efficiency the younger group did better by nine net percentage points, but there was only a one-point drop between the thirty to forty-four and the sixty and up age groups. There were considerable individual differences, as indicated by the fact that the oldest woman rated seven points higher on efficiency than the average for the younger group.

When total appraisals of each worker were considered, there were vast differences between individuals but virtually no difference between age groups. Most of the employees hired at age forty-five or over—even at sixty or over—were favorably appraised. In fact, most of them with less than two years' experience were given higher net appraisals than younger men currently being hired (Bowers, 1952).

A further study made at the same company involved 903 men, aged eighteen to seventy-six, who had been with the company at least two years.

In addition to confirming previous results, this study compared skilled with unskilled and clerical workers and gave special attention to workers over seventy. The three work groups showed little difference in traits mentioned, although in the unskilled group efficiency increased with age. This, along with the increase in steadiness and attendance, shows the value of older people for this type of work. The mean ratings for clerical workers fell slowly with age but, except in the case of speed ratings, were never more than ten points below mean ratings of the younger group. In no group did more older men than younger ones receive negative evaluations, indicating low total worth. In fact the

greatest proportion of low ratings for any group was in the thirty to forty-four age group for unskilled workers (Smith, 1953).

In general, then, older workers held their own in unskilled and clerical work as well as in skilled work, which many people believe is the only type they can handle. A few representative comments made about workers over seventy indicate their advantages and disadvantages to the company.

"Upholsterer, 75; an excellent man Adept at all types of tailoring. A top producer and regular worker; in excellent health. Although his eyes are failing, he is still the best "

"Shipping Clerk, 71; slowing down, but still does a good day's work. Talks a lot, but is very willing "

"Inventory Clerk, 70, outstanding, plans his work, looks ahead, requires little supervision. Doesn't want responsibility. Excellent sick leave record "

"Processing Clerk, 75; a very good man Will try anything, but is bullheaded at times. Has excellent attendance record. Age is slowing him down but he is dependable, steady, and accurate."

That elderly workers may be particularly valuable for part-time employment was brought out in a study of 597 department store saleswomen.

The older women were available for work on more days and proved to be satisfactory employees, as shown in the table below in the high percentage of them who received wage increases as compared to younger workers. Many of the older saleswomen built up their own clientele and thus attracted a certain amount of business to the store.

Age when Hired	Number of Women	Work Days Available	Per Cent Receiving Wage Increase
14-30	300	103	11
31-45	192	196	21
46-60	98	305	33
61-up	7	412	57

In attempting to provide easier working conditions for older employees, the department store allowed the older workers to come in late and leave early, thus shortening their day and enabling them to avoid the crowded periods on buses. The store had the advantage of their older help during the noon

hour and early afternoon rush period, when full-time workers were having lunch (Stanton, 1951).

Although a department store may find it easier than many other businesses to make adjustments for elderly employees, almost any company can provide certain changes in hours or type of work which will make it possible for the elderly worker to remain productive. If careful thought is given to the problem, such changes can be made without making the worker feel he is being downgraded in any way.

In considering studies of older workers such as those discussed above, we must remember that most studies have been cross-sectional and tell us nothing about the changes that age may bring in a particular individual. The effects of aging differ greatly from person to person. This suggests that a selective retirement policy may be the best one from the standpoint of both the employer and the worker (Kleemeier, 1954).

More needs to be done to enable professional workers to continue to be productive after their official retirement. One psychologist has cited the example of a retired university professor who published a book at the age of ninety-six, seventy-five years after his first professional paper had been published (Pressey, 1954). The university had provided him with office space and a certain amount of secretarial help. If more retired professors, research directors, and other professional persons were provided with minimum facilities of this kind, professional retirement could be a period of continuing achievement.

HIRING

THE HANDICAPPED WORKER

Like older people, the physically handicapped have too often been overlooked as potential employees, even though they have repeatedly shown themselves to be valuable workers. Employers who have hired handicapped workers report lower rates of absenteeism, termination, and accidents for them than for other workers (Stone and Kendall, 1956). When they are properly placed, their productivity equals or excels that of the average worker.

Many sources of handicapped workers are open to the employer—state offices of vocational rehabilitation, state industrial commis-

sions, and private welfare agencies. A particularly important source is the Veterans Administration, which places thousands of disabled veterans in industry every year. In fact, 95 per cent of the forty thousand veterans suffering from heart and circulatory disabilities have either full or part-time employment (*Science News Letter*, 1956).

The blind comprise a particularly large group of handicapped workers. Although people tend to think of the blind as valuable chiefly for work requiring unusual acuity of one of the other senses, such as tuning pianos or making fine discriminations through the sense of touch, they have proved their ability to do many other jobs as well.

The versatility of the blind was brought out in a recent project in New York (Altman and Baumann, 1955). The United States Employment Service made funds available to the New York State Employment Service for a demonstration project in placement of blind workers. The State Employment Service worked with other agencies in locating blind persons seeking employment, but its own interviewers made all decisions as to whether or not the individual was ready for steady work. All blind applicants came to one center, where a case-work approach was used in placement. The interviewers spent about half their time registering, counseling, selecting, and referring workers. The other half was spent in promotional activities with employers.

In many cases it was difficult to sell employers on the idea of hiring blind workers. In general, the most effective selling point was the person's ability to do the job. A frank discussion of the advantages and disadvantages of hiring the blind was usually helpful. The interviewers concentrated on the personality and abilities of specific applicants rather than upon a total program of hiring the handicapped. Such practical problems as transportation of the worker to his job were also discussed. As a final aid to both the worker and his employer, the State Employment Service gave the new employee a brief orientation to the physical features of his job—that is, they showed him the location of lunchrooms, water coolers, and other facilities, pointed out obstacles, and often helped him arrange his work materials.

In ten months ninety-one blind persons were placed by this project. These people

obtained jobs in all fields, from professional services to clerical and agricultural work. A number of dictaphone operators and power-press operators were placed. Among the more unusual placements were one medical social worker and one outside salesman of stocks.

Another common handicap, deafness, may actually be an advantage in certain jobs.

This was shown in the case of Maria, a twenty-year-old deaf member of a minority race trained as a typist by the Colorado State Office of Vocational Rehabilitation. Maria could not use a hearing aid, but she was a lip reader. She was placed with a direct-mail concern which had had trouble with girls not being able to accommodate to the noise and rhythm of the automatic typewriters used. After two months both Maria and her employer were well satisfied. In fact, the employer was looking for another deaf typist (Adams, 1955).

The deaf may become increasingly valuable to the armed services. Any noise above 120 decibels in intensity produces pain, and sound above 140 decibels is completely intolerable to the average person; but present jet planes create sound levels of about 130 decibels, and new ones are planned which will go as high as 160 or 170 decibels. The Office of Naval Research is currently studying the effects of such intense sounds on hearing. One of its investigators has suggested that, in order to avoid causing intense pain or actual hearing loss to normal individuals, totally deaf pilots and other workers be used with jet airplanes (Page, 1956).

If prospective employers evaluate the physically handicapped worker as they would any other job applicant—in terms of whether he will be able to do a particular job well—many more handicapped people will find a productive and satisfying place in our economy.

THE UNDERSTANDING AND CONTROL OF HUMAN RELATIONS

When employees are dissatisfied despite adequate wages and reasonable hours, the trouble can frequently be traced to the failure

of management—and sometimes of union officials—to understand workers as human beings. In general, both employers and union leaders have overemphasized the importance of economic factors in determining worker satisfaction.

This lack of understanding was brought out clearly in a study in which workers from several companies were asked to choose from a list of seventy-one items the five that were most important to them personally. Fifty top executives of the same companies and forty-two union officers were asked to rank the items in the order they thought the workers would rank them. Results for the ten items most frequently mentioned by the workers are shown in the table below. Although the most frequently mentioned item, job security, was recognized as important by executives and union officials nearly as often as by the workers themselves, most other items showed a wide discrepancy in rankings. The workers' desire to be kept informed of their successes and failures (fifth in workers' rankings) was not even included in the first forty items mentioned by either executives or union leaders (National Industrial Conference Board, 1947).

Ranks Assigned to Different Job Factors

Factors	Employees	Executives	Union officers
job security—employment stabilization	1	2	2
opportunities in the company for advancement	2	4	18
compensation—base pay	3	1	1
employee financial benefits (pensions, etc.)	4	8	19
practice of informing you of your job status (successes and failures)	5	40+*	40+
type of work	6	7	39
vacation and holiday practices	7	3	8
profit-sharing plans	8	13	40+
physical working conditions (on the job)	9	5	4
company's attitude toward employees (liberal or conservative interpretation of policies)	10	6	6

*A rank of 40+ means not in the top forty ranks.

Such basic misconceptions on the part of management and employee representatives are bound to cause friction.

To prevent this kind of misunderstanding and to help executives gain greater insight into the needs of employees as human beings, present-day industry is turning more and more to training in human relations. A pioneer effort was the National Training Laboratory in Group Development at Bethel, Maine, and more recently the Southwestern Human Relations Laboratory has been organized. The latter holds annual sessions each summer in one of its three cooperating states—Colorado, Kansas, or Texas.

Since human relations training is not well suited to conventional classroom teaching methods, the human relations training laboratory uses special techniques. Usually the training takes place in a "cultural island" such as a camp or resort, where participants are relatively free from the press of decisions and deadlines characteristic of daily life (Blake and Mouton, 1955). Although the participants have common occupational interests, the fact that they come from different cities and corporations makes the learning situation less

threatening than if they were in their own company organization. Thus they can feel free to examine their behavior and learn how it influences others.

Usually a human relations program includes a number of general sessions at which major problems of leadership, group dynamics, community organization, and even social science theory are presented and discussed. At critique sessions held at the close of each day, participants evaluate the training program. The institute itself serves as a sort of "experimental community" whose members discuss and solve human relations problems as they live together.

In "content groups" more specific problems that arise in work activities are discussed. Content groups may be composed of members of one occupational group, or they may be interdisciplinary. For example, social case workers might meet with public health nurses or obtain the opinion of a child psychiatrist concerning some of their professional problems. In "process groups," on the other hand, the content discussed is of secondary importance. Here the group is primarily concerned with studying the actual operation or dynam-



Instead of depending entirely on wages to keep workers satisfied with their jobs, more and more industries are recognizing the importance of good human relations. Participation in a human relations training laboratory helps executives to gain insight into the needs of employees as human beings. Above is a session of the National Training Laboratories.



Industries have used many methods in trying to achieve better employee relations. The Anaconda Copper Mining Company has built several clubhouses to provide recreational activities for its employees. At left, a club is holding a square dance. The Electro-Motive Division of General Motors has an annual open house when workers may tour the plant with their families to gain an understanding of how their work contributes to the total operation. Such tours foster pride and interest in the company.

ics of the group itself. Through such process groups, also called training groups, the participants gain many skills which can be applied when they return to their own organizations. Other special techniques employed in human relations training include role playing, films, skits, panels, and subgroup discussions carried on by six to ten members.

The human relations laboratory may also be used to conduct research on group processes and on methods of training. At the same time it provides training in how this kind of social science research is conducted. As further experimentation is carried on, the versatile human relations laboratory may come to play a greater part both in industry and in other areas.

THE NEED

FOR SATISFYING WORK

Modern factory work has, in some instances, developed in such a way as to deny men some of the satisfactions that were provided by work in an earlier day. Before the time of huge factories the shoemaker and the cabinetmaker, for example, took real interest in craftsmanship. Their work required skill, patience, and often considerable artistic ability. They enjoyed admiration and respect for their craftsmanship and felt that they were performing a useful function in the community.

Today the work on most products is broken down into many stages, each performed by a different person. The worker on the modern production line performs a few simple operations hour after hour, day in and day out, weeks and months upon end. Though he may enjoy the experience of working with powerful and effective machinery, he rarely has the satisfaction of seeing the final product of his efforts. Even away from the production line, work is often of the most routine sort: punching tickets, running an addressograph machine, or typing letters to strangers.

Work under such conditions has little intrinsic interest. Many people soon feel stifled because the pleasure of creation is denied them. Boredom and restlessness develop into a sense of frustration, and the worker searches for someone or something to blame. He may seize upon any excuse for stopping work.

Is there any brighter side to the picture—any relief from the psychological disturbance caused by monotonous routine work? Fortunately, correctives for industrial monotony are many.

1. *Selecting the right workers.* Although highly repetitive work is an inevitable component of today's system of specialized mass production, the unfortunate effects of monotony can be greatly reduced if employers take care to hire people who do not object to routine work.

2. *Scheduling rest periods.* Industrial psychologists have found that rest periods during the day serve to break the monotony and, if well-planned, actually increase production for the day as a whole.

3. *Allowing social contacts.* Workers often do not mind performing simple tasks if they are allowed to work in social groups where they can talk with fellow workers. When the task is very simple, conversation does not interfere with efficiency and, in fact, may even increase it.

4. *Planning activities for after work.* The machine age has made it possible to shorten the working day from twelve or even sixteen hours to only seven or eight. If used for recreation and self-improvement, the new leisure time can help counteract the monotony of the machine. Obviously management cannot supply a complete and satisfactory social life for employees, but it can sponsor social and educational activities that will add variety to the worker's life and so help compensate him for the dullness of his working hours. After-work activities also give employees a chance to become better acquainted with the other workers. This often leads to more pleasant and productive working relationships.

5. *Showing how the job is important.* Monotonous work is much more interesting if it has meaning. To meet a common grievance among modern factory workers—that "all of us work on parts of things and never see the complete product put together"—the management of one large company decided to hold an "open house." Every day for two weeks, after the regular working day was over, employees were invited to pass through the factory—to explore corners they had not known existed, to witness operations they had never seen before. Thus they could see how they were working together on a common product, not spending their time on some isolated task that had no meaning or purpose. In fact, their pride and interest in what they were doing grew to the point where they brought their wives and families with them to tour the plant.

6. *Building pride in the company.* A worker identifies himself with the company he works for and with its products. Morale suffers when employees feel that their company is second-rate or that the product they are working on is shoddy. When workers have a feeling of real pride in the quality of their product, on

the other hand, morale and production go up—while turnover decreases.

7. *Building identity with the enterprise system.* Surveys show that workers typically have very little understanding of the ways in which modern business and industry operate. Many progressive corporations are remedying this situation by conducting discussion courses or other educational programs. Most workers take considerable satisfaction in realizing that they, as well as management and stockholders, are part of the enterprise system and have a stake in it.

Many corporations have developed plans whereby their workers can participate in the profits of the corporation through bonus plans or by purchasing stock. These plans not only reward employees financially but also give them a feeling of identity with the company and its success.

THE 'NEED TO BELONG'

Part of the satisfaction of work consists in feeling that what you are doing has social value. Before the days of big cities and big industry, every worker saw his efforts as part of a whole community life. The shoemaker or boatbuilder or farmer often followed his father's trade in an intimate community where his family had lived and worked for generations. He was either self-employed or worked for people whom he knew well.

Today this has all changed. The "need to belong" is especially strong in modern society, because the traditional institutions are losing their power to give the individual security. The average individual in big-city society does not feel that he is an integral part of any important group. The modern industrial worker often experiences social frustration in his home, church, and neighborhood as well as in his work.

The industrial manager cannot remedy the social deficiencies of other institutions, but he can see that the workers in his plant or office operate as a team. Teamwork helps satisfy the worker's need to belong, improves morale, and increases productive efficiency.

Effects of teamwork on productivity. Interestingly enough, our present realization of the importance of psychological factors grew out of a study based on the mistaken assumption that employees' attitudes do not have marked effects on their productivity.

In the late 1920's a series of experiments was sponsored by the management of the Hawthorne plant of the Western Electric Company in Chicago. The investigators set out to measure the effect that changes in environmental conditions had on the production of a group of women who were engaged in assembling a piece of electrical apparatus. In order to make the experiment as objective as possible, they placed the group in a special shop where all factors could be controlled and observed. For a period of about two months, the workers (all of whom were experienced) operated under the usual conditions and at their accustomed rate. This period was used as a base or control period for subsequent comparisons.

It was then explained to the group that they would be used as subjects in experiments to test the effects of rest periods and various environmental changes and that their pay would not suffer regardless of what happened to their production. The investigators were anxious to avoid introducing any extraneous psychological factors (such as resentment at a particular change) which might influence the workers' production after the change was made and so not allow the true effect of the change itself to be observed in production records. In other words, they wanted to hold the workers' attitudes "constant." So each time an innovation was made in the work schedule or in working conditions, the workers were informed of it. The investigators even asked the workers for suggestions about what changes it would be useful to try. At the same time, supervision was lessened. Certain disciplinary rules were relaxed, and the women were now permitted to talk while they worked. Since they were rather isolated from other workers in the plant, they became a close-knit, friendly group during the investigation.

It was found that each time a change was made, the production of the group went up, slowly but surely. It did not seem to matter whether the change was in the form of introducing a rest period, changing the work method, or whatever—each change was followed by improvement. This uniformity of cause and effect eventually aroused suspicion, and it was decided to conduct a control experiment by restoring the original conditions. If the increases in production were actually caused by the changes that had been deliberately introduced, then production should fall back to where it was in the base or control period.

To the amazement of some, the restoration of the old conditions brought still more increase in production. When the workers were interviewed to discover the reason for such an unexpected result, there was general agreement that they liked being consulted

about their working conditions, that they liked the lessened supervision and discipline, that they now felt themselves to be a team participating with management in a cooperative enterprise. Moreover, the closer social relationships within the group made each worker feel part of a solid group of friends. Cooperation and companionship—extraneous psychological factors that had been "introduced" unintentionally—made these workers happier and hence more productive. The workers had not even realized that they were producing more with each change. In fact, they actually thought the work was getting lighter because they felt less tired at night (Roethlisberger and Dickson, 1939).

Subsequent studies have confirmed and expanded these early findings concerning the importance of a feeling of belonging.

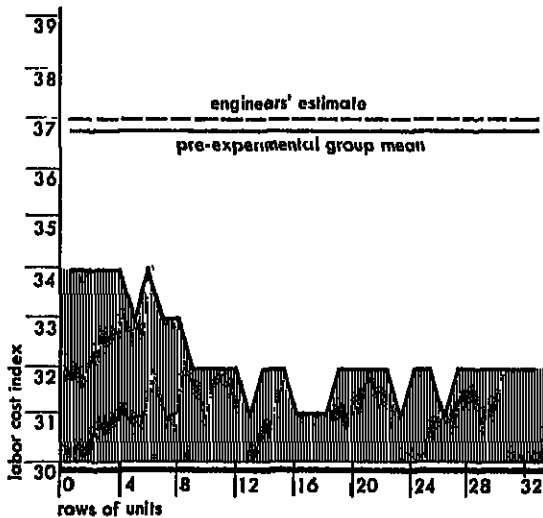
Ordinarily housing construction workers are assigned arbitrarily to work groups by the foreman. One experimenter decided to see how their work would be affected if they were allowed to choose their partners. Each man was asked to list his first, second, and third choices of a partner. Assignments were then made in accordance with these choices, many men receiving their first choices. Larger groups were formed by fusing two teams in accordance with the choices, more than four persons in a group seldom being required.

As might be expected, the workers enjoyed their work much more in these "buddy-work-teams." As one man expressed it, "Seems as though everything flows a lot smoother. It makes you feel more comfortable working—and I don't waste any time bickering about who's going to do what and how. We just seem to go ahead and do it. The work's a lot more interesting, too, when you've got your buddy working with you. You certainly like it a lot better anyway." This increased satisfaction was reflected in a significant decrease in turnover rate. In addition, total labor costs and even material costs decreased substantially, as indicated in the graphs on page 468 (Van Zelst, 1952).

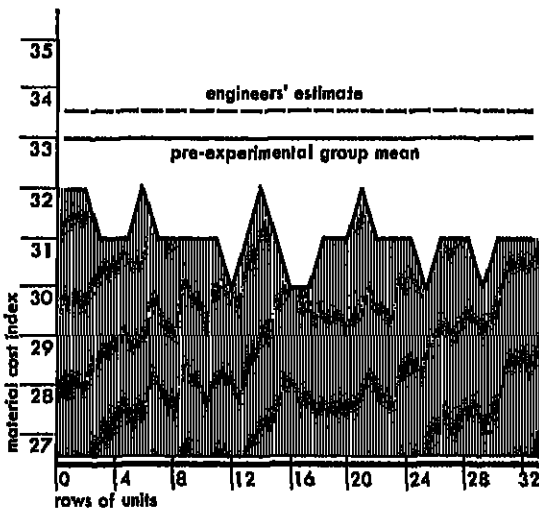
Encouraging social groupings. Intelligent management today encourages teamwork among employees, realizing that both workers and management stand to benefit. Social grouping can be fostered in several ways:

1. In large industrial plants, where the backgrounds and interests of the workers are likely to be very different, management can make an effort to place together employees who have similar backgrounds, who are friends

Labor Costs of Buddy-Work-Teams Compared with Engineers' Estimate and Pre-Experimental Costs



Materials Costs of Buddy-Work-Teams Compared with Engineers' Estimate and Pre-Experimental Costs



outside the plant, or who seem to have a natural liking for each other. The importance of friendly associates is shown by a report of a girl who resisted being given a better-paying job because she would have to leave the group of friends in her present department (Mayo, 1945). Of course, such groups must be encouraged to have more than a narrowly personal orientation.

2. When workers have to be loaned or transferred from one department to another, management should try in so far as possible to keep working teams intact.

3. When innovations in machinery or work routine are introduced, management should remember to take into consideration the social patterns that have been established.

4. Whenever possible, payments should be made according to *group* output rather than *individual* output, in order to encourage teamwork.

5. Whenever possible, groups should be kept small enough that the members can become well acquainted with each other (Marriott, 1951).

THE NEED FOR TWO-WAY COMMUNICATION

The classic Hawthorne experiment showed that the morale of workers improved when they were encouraged to discuss the various aspects of their jobs. You have already seen that employees often do not understand what is involved in the conduct of a business enterprise and that employers frequently do not understand what their employees really want from their jobs. Such misconceptions on both sides can be cleared up by a two-way system of communication between management and the workers.

There are many ways in which management can establish two-way communication. The best way will depend upon the size of the company, how spread out it is, whether or not it is unionized, the educational level of the employees, and many other factors. What has happened in the past and how the employees already feel toward management are also very important factors. The general rule in establishing communication between management and employees is to proceed slowly, noting and capitalizing on each forward step. Some of the procedures currently being used will be briefly described.

Employee opinion polls. Management can learn much about the feelings and opinions of its workers by conducting annual opinion surveys. Typically the employee is given an opportunity to answer in complete secrecy a series of questions regarding the conditions of his work, the fairness of his pay in relation to that for other jobs in his company, how he is treated by his supervisor, and so on.

Often the best way to conduct an opinion survey is for the employer to send a letter to each employee at his home, enclosing a standard ballot and a stamped envelope addressed to some person outside the company who has a reputation for honesty and fair-mindedness—perhaps a professor of industrial relations or industrial psychology in a local university. The outsider tabulates the answers and turns them over to management. In this way the employees have no reason to fear that their replies can ever be tied to them as individuals and hence become the basis of reprisal.

One study has indicated that the aspects of the job with which an employee is dissatisfied are the ones that seem most important to him. Therefore, attitude surveys may tell more about the unsatisfactory conditions than about the satisfactory ones (Decker, 1955). According to the same study, dissatisfied employees show a higher degree of discrimination in evaluating the various aspects of the job than do the satisfied ones. Thus it may be that these employees are management's most reliable source of information.

Employee opinion polls will not be effective unless something is done on the basis of the findings. When poor conditions are reported, management should make an effort to change them—or, if necessary, explain why they cannot be corrected.

Using natural leaders in the work force. Able members of management are coming to realize increasingly that their leadership depends as much upon whether their subordinates accept them as it does upon the authority given them by the owners. In Chapter 14 you saw the disadvantages of the "headman" type of leadership. Management and supervisors are employed as "headmen" by the company's owners, but they must also be leaders in their own right if the work is to be done properly and on time. The good manager depends upon meetings with natural employee leaders for two-way communication. He gets information from them and passes information along through them. These meetings should be held openly, with the knowledge of the entire working force, and no one should be rewarded or punished for any of his suggestions.

Written communications. There are many ways in which the printed or written word can be passed in either direction. Among these are employee handbooks, bulletin boards, em-

ployee papers, suggestion boxes, and various kinds of contests. Often it is helpful to supplement written communications with oral ones. According to one study, factual information is best transmitted when the material is presented orally, with written material available at the same time (Dahle, 1954).

Written communications frequently fail to accomplish their purpose because they are in language that is "over the heads" of the audience for whom they are intended.

In a recent study the handbooks of sixteen corporations were analyzed in terms of difficulty, using Flesch Reading Ease Scores as a measure. It was found that a third of the books were written in language definitely too difficult for their audiences. The most extreme case was that of a corporation whose average employee had only a fourth-grade education but whose handbook was written at a level of difficulty suitable for college students and graduates (Carlucci and Crissy, 1951).

Obviously such attempts to communicate cannot be very successful.

The suggestion box is the most common device for getting written opinions from employees. Another common device is the company contest.

In the General Motors Corporation a company-wide contest was conducted in which employees were asked to write on the subject: "My Job and Why I Like It." A total of 174,859 letters were received and carefully analyzed, providing management with much valuable insight (Evans and Laseau, 1949).

Care should be taken in evaluating such contest results, because employees naturally tend to write what they think management wants to hear, in the hope of winning a prize. Thus, in the General Motors contest, such factors as "interesting and important job" and "pride in the company" ranked much higher as reasons for job satisfaction than similar factors have done in other measures of workers' attitudes (Stagner, 1956).

HELPING THE WORKER WITH HIS ADJUSTMENT PROBLEMS

Free communication between the worker and some member of management serves not only as a means of exchanging information but

also as a simple form of psychotherapy. Catharsis, so effective in the clinic, proves its worth also in the office and the factory. It is valuable for the worker to unburden himself not only of difficulties in his work but also of difficulties in his home and social life. Management finds it worth while to provide means of relief from emotional strain, whatever its origin.

Not every foreman or supervisor is skilled enough in human relationships to help the employee with his adjustment problems. For this reason many firms maintain one or more psychological counselors whose function is to help the dissatisfied or worried employee work out his difficulties.

HUMAN FACTORS IN ENGINEERING DESIGN

No matter how technically advanced a machine may be, it will not aid production as it should if it is not suited to the worker or if its design does not provide for his safety. All planning of work space and equipment must take into account the sensory capacities, strength, and body dimensions of the worker. It should also consider his response to various physical conditions of the working environment. This type of planning is known as *human engineering*, or *engineering psychology*. Although efficiency, as measured by speed and accuracy in operating equipment, is the primary aim of human engineering, the safety and comfort of the operator are also very important considerations. (For further discussion, see pages 555-558.)

The designer plans every phase of the operation carefully, considering every component in the system whether "hardware" or "human." In a *man-machine system* the human component may act as an amplifier, a filter, a computer, or some other element. After the designer has selected the function to be performed by the human component and the operations by which this function must be carried out, he sets the limits of sensory and motor adjustments which will be demanded of the human component. Careful checking of the final design is important. Let us look at some of the details that must be considered.

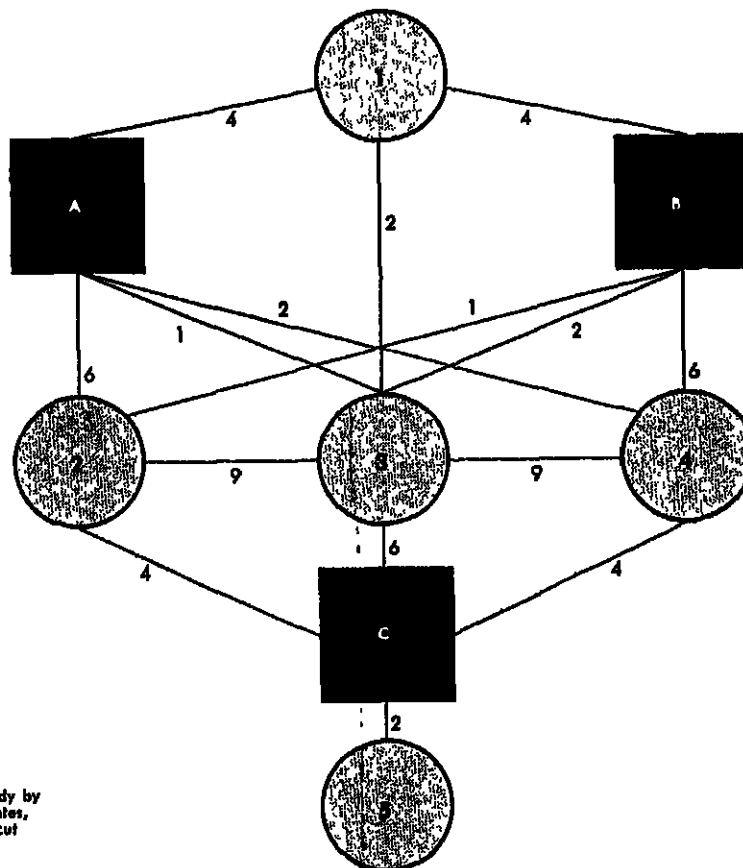
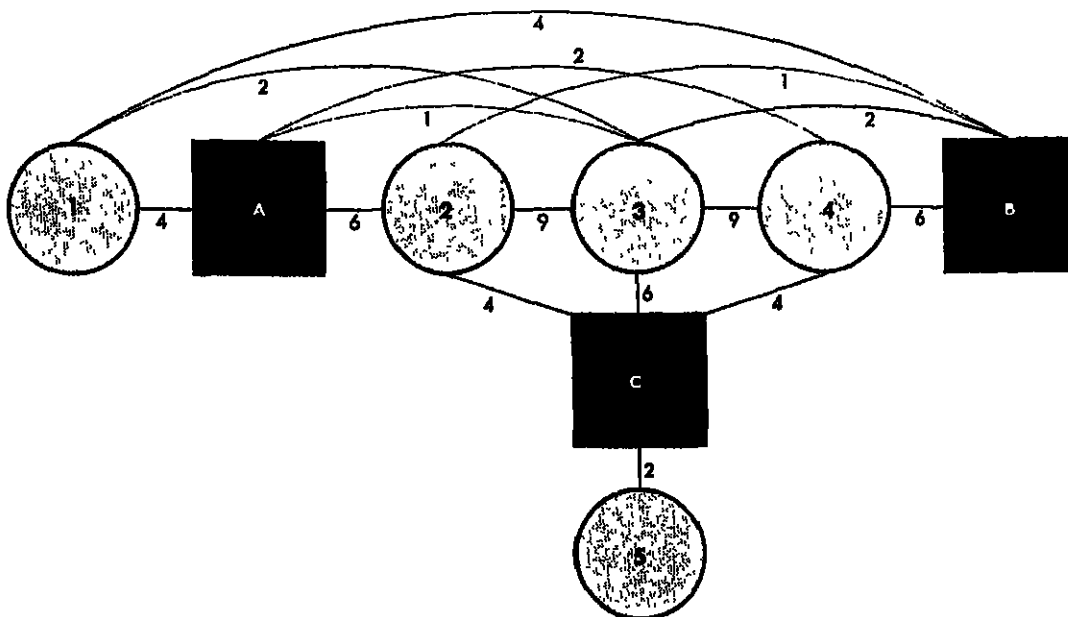
ARRANGING EQUIPMENT AND WORK SPACE

Equipment and work space are important factors in determining worker efficiency. Ordinarily it is wise not to place bins, tools, or machines outside what is known as the maximum working area—the area within normal easy reach of the worker (Chiselli and Brown, 1955). However, a change in body posture is sometimes desirable; a certain amount of bending and reaching may increase efficiency.

Equipment arrangement should be based upon the *links* necessary for performing the task in question—links between men and machines, between machines and machines, and between men and other men. These include *visual links*, *talking links*, *walking links*, and *control links* (Woodson, 1954). To insure adequate visual links, illumination must be good. Viewing distance must not be too great, and viewing must not be obstructed by other equipment or people. For smooth talking and walking links, the distance between workers must not be too great; otherwise, shouting may become necessary or walking time may be excessive. For control links, the engineer must list all components of the system, determine the type of links between them, and determine the importance of each link. (For an example of how equipment arrangement can be based on links, see page 471.)

Often the designer decides upon the final arrangement of men and equipment by making a scale drawing of the working area and a scaled three-dimensional cutout of each major component. By moving the cutouts about he can determine the most efficient placement of equipment. The task is further complicated by the necessity for seeing that each worker has adequate ventilation, illumination, storage facilities, and safety devices.

It has been shown that pre-positioning of tools increases efficiency—that is, tools should be placed as nearly as possible in the location where they will be used and at the proper angle to be grasped most easily. In one study, 24.0 bolts were tightened per minute with a pre-positioned screwdriver, as compared to only 16.4 when the screwdriver was not pre-positioned (Barnes and Mundel, 1939). A common example of a pre-positioned tool is a fountain pen desk set.



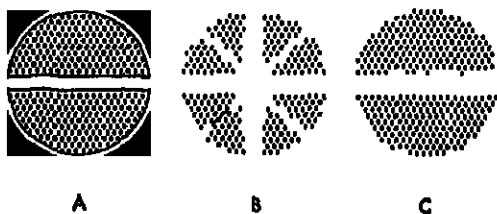
Adapted from a study by
Dunlap and Associates,
Stamford, Connecticut

Worker efficiency is increased when arrangement of equipment and men is based upon the man-to-man and man-to-machine links necessary to perform the task being done. The diagrams above show two arrangements of five men (the circles) and three machines (the squares). The numbers on the connecting lines indicate link values—the frequency and importance of the contacts. The more important and frequent the contact, the higher the link value. At top is the original layout; below it is the revised layout, which is more efficient in that highly linked units (men and machines) are placed closer together.

DESIGNING TOOLS AND EQUIPMENT

Designing tools and equipment in such a way that the worker can use them with maximum efficiency is no small task. Even such an apparently simple tool as the common screwdriver becomes complicated when considered in relation to human capacities and limitations. It has been shown, for example, that when a great deal of force is needed to drive a screw, a tool with a handle of uniform diameter is most efficient (Barnes, 1946). But for light work the best screwdriver is one whose handle is smaller on the lower part than on the upper part—the small part of the handle can be twisted rapidly and the large end used for better leverage in tightening up a screw (Hunt, 1934). The other end of the screwdriver, the bit, is also important, as shown by a study in which three different types were studied.

The traditional bit (C, below) tends to slip out of the slot if the operator tilts the screwdriver, resulting in loss of time as well as possible injury to hands or equipment. A screwdriver which fits around the screw as well as into a slot (A, below) is better in this respect. In this study workers using screwdrivers with a type-A bit were able to tighten 121 screws per minute when the screws were already inserted and 6.6 per minute when the operator inserted them himself; under similar conditions operators using traditional screwdrivers were able to tighten only 10.7 and 5.7 screws per minute. A third type of bit (B, below) ranked between the other two (Barnes and Mundel, 1939).



The first considerations in designing equipment are to minimize the possibility of human error and to make the best use of the worker's capacities. But it is also important to make certain that the new equipment will be acceptable to the worker and that he is aware of its advantages (Chiselli and Brown, 1955).

Lack of confidence or experience may make a mechanic rely on a pair of ordinary pliers instead of a new wrench especially designed to do a particular job.

Many workers today must operate machinery that is tremendously complex. Instead of working directly with relatively simple hand tools, they deal primarily with a series of controls and dials that enable them to regulate the machinery's operation. Under these conditions the efficiency of the worker's equipment becomes increasingly important, for the machine has greatly multiplied each worker's potential output—and at the same time has made errors much more costly. For this reason industrial engineers and psychologists have been increasingly concerned with the problem of designing dials and controls that will minimize the possibility of human error. Three of the studies devoted to the problem of readability in dials are summarized with illustrations on page 473.

The kinds of devices used for controlling technological apparatus may be classified according to the type of human reaction that is involved in their operation (Chimpanis, Garner, and Morgan, 1949).

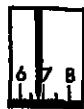
1. One type of control system involves a *static reaction*, in which the operator holds something in a fixed position—for example, when he holds a lathe tool against turning material.

2. When a *blind-position reaction* is required, the individual cannot tell whether he is accurate or not until his response is accomplished. He must grope blindly for the controls, as a driver does for the brake pedal or gear shift lever while keeping his eyes on the road. Research has shown that blind-position reactions are usually most accurate when the controls are directly in front of the operator (Fitts, 1947).

3. Some reactions involve *visual-positioning movements*. Here the individual gets visual information while operating the control. In setting a watch, for example, you can tell from the position of the hands whether or not you have turned the stem far enough.

4. A fourth type of reaction involves *repetitive movements*, such as those used in turning a crank.

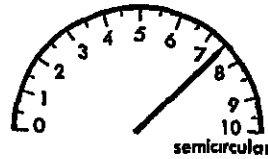
5. The most complex type of reaction involves *continuous-adjustive movements*, where the operator does not seek a set mark (as in setting a watch) but rather must keep adjust-



open window



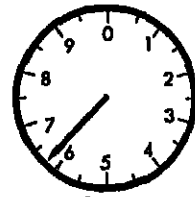
vertical



semicircular



horizontal



round

One of the best known studies on what is the most readable dial revealed that, of the five dials illustrated above, the open window dial can be read with the least error (Sleight, 1948). The design of the numerals is also important to accurate dial reading. Plain letters and figures, without flourishes, are most easily read. The ratio of height to width of the numeral should be three-to-one in most cases, except on curved counter drums, where a ratio of one-to-one is better (Woodson, 1954).

The unconventional numerals below, the revised Lansdell digits, are not the latest Paris fashions in figures to make your dials ultra-modern. Instead, they represent a practical and successful attempt to design numerals that can be read more easily under varied conditions of exposure and illumination. They were compared in a recent study with the conventional Mackworth digits (below) which had previously been shown to be more legible than other conventional digits (Foley, 1956). The Lansdell digits were significantly more legible than the Mackworth digits under all illumination levels and exposure times and when viewed from various angles. At low illumination levels, white Lansdell digits on a black background were more easily read, while black digits on white were more legible at high illumination levels.



Lansdell digits



Mackworth digits

ing the controls to a changing situation. The operation of many machines requires this type of reaction—a simple example is steering a car.

Each of these types of control system presents special problems to the engineering psychologist, but there are at least three factors that he must consider in the design of any control (Ghiselli and Brown, 1955). First, he must consider the *force* necessary to operate the control. Secondly, he must see to it that the control is adequately *distinguishable*. If a complex panel of controls is needed, it becomes particularly important that each control can be easily located and identified. Finally, he must consider the factor of *realism*, or naturalness of operation. For example, it is most natural for a lever controlling a lifting machine to be raised when the lift is to be raised and lowered when the lift is to be

lowered. If a control knob moves a dial in a clockwise direction, the knob should also move clockwise.

Comparable controls on similar machines should not be too different. During World War II it was found that accidents were being caused by differences in design between aircraft flown by the same pilots. In one case the same movement of a similarly placed lever produced *opposite* and sometimes fatal results.

PROVIDING FOR PHYSICAL SAFETY

Both management and labor are vitally concerned with the prevention of industrial accidents. The human cost and monetary cost of accidents are high. Fortunately, industrial

psychologists have been able to isolate many of the factors responsible for accidents and thus to minimize the likelihood of their occurring.

Most large companies emphasize safety. In fact, statistics show that the accident rate for companies employing five hundred persons or more is only 10.5 per million man-hours worked, as compared to 22.3 for companies employing fewer than twenty-five persons (National Safety Council, 1953). These figures are only averages, of course.

One investigator found that the majority of plant executives base their estimates of the cost of industrial accidents on the amount of premiums paid by the company for workmen's compensation insurance (Simonds, 1951). Actually such direct costs of accidents represent only about half the total expense, which includes the cost of repairing damaged equipment, of training substitute workers, of the supervisor's time, and so on.

Probably most companies are stopping short of the most profitable investment in safety (Smith, 1955). A particularly effective plan is the establishment of a company accident clinic. Here each accident is examined by a professional team composed of a safety engineer, an industrial physician, a psychiatrist, and a psychologist. If such a clinic has sufficient authority to make sure its recommendations are followed, it can do much to decrease the company's accident rate.

The use of safety devices. One specific way in which a company can cut down on accidents is to install good safety devices. In designing a safety device several principles should be observed (Maier, 1946). In the first place, the device must be foolproof. An imperfect safety device can be more dangerous than no safety device at all if it gives the worker a false sense of security and leads him to neglect ordinary precautions. When a safety device is installed, workers should be told exactly what its uses and limitations are.

Safety devices should be constructed so that they will have to be used. For example, a machine may be designed so that it will not operate unless a safety button is held down. Unless the device is constructed so that the worker must actually hold the button down with his *hand*, he may prop a stick against it or in some other way get around holding the button down, so that he can operate the machine at all times. Educating workers in

the value of safety devices helps prevent this type of circumvention. If safety devices are carefully selected so that they will not interfere with production or ease of operation, employees will be more cooperative in using them.

Atmospheric conditions. Numerous studies have shown that there are fewer accidents when the working spaces are properly air-conditioned for temperature and humidity.

A very thorough study of this relationship was made over a period of four years on more than ten thousand coal miners. A rise in temperature from 63° F. to 78° was accompanied by a correlated increase in the frequency of accidents (particularly of the less serious kinds) as measured by number of days lost from work (Vernon, 1936).

Accident rates also increase when the temperature falls *below* an ideal level.

Illumination. Proper lighting has been found to increase production per man and to decrease errors and accidents per unit of work.

One study found that key-punch operators increased their production rate by 58 per cent and reduced their errors by 69 per cent when adequate illumination was provided (Luckiesh and Moss, 1937).

Effect of production rate. What happens to accuracy of work and to the accident rate when production is speeded up? These relationships have been studied by many psychologists in a number of experimental situations and in actual factory operations. A worker tends to be most accurate when working at his natural pace; he becomes more susceptible to accidents if pushed beyond it.

In one study of workers in a fuse factory during World War I it was found that a 25 per cent increase in production rate was accompanied by a 60 per cent increase in frequency of accidents that required treatment at the hospital or dressing station (Vernon, 1918).

Age and experience. Various studies have shown that age and experience play a part in accidents.

One recent study was made in a copper plant where no formal training was given before the actual work began, so that all learning occurred on the job. Previous experience greatly decreased the

accident rate during the first five months of employment, when employees were learning work methods and safety habits. However, experience was of little significance after that point.

This study also showed clearly that older workers tended to have fewer accidents than younger ones, even when the two age groups had the same amount of experience on the job. In fact, beginning in the second month new employees of the older group (mean age 41.1) had fewer accidents than younger workers (mean age 28.7) with much more experience (Van Zelst, 1954).

Proneness to accident. Industrial accidents are not distributed according to chance. Studies in the laboratory and factory have shown that certain individuals are more *prone*, or susceptible, to accidents than others.

Sometimes accident proneness is temporary, brought on by special problems and worries. One psychologist made a careful clinical investigation of four hundred cases of industrial accidents in Germany over a seven-year period. His conclusion was that "more than half took place when the worker was in a worried, apprehensive or some other low emotional state" (Hersey, 1936).

As might be expected, excessive drinking is also related to accident proneness. As long ago as 1906 the Sickness Insurance Fund of Leipzig, Germany, reported that the accident rate per thousand members was 44 for the group as a whole and 123 for those who were chronic drinkers (Vernon, 1936).

Two ways of screening out accident-prone workers have been used in industry. The most common method has been to remove workers who have had frequent accidents from their jobs. The other procedure is to screen out workers on the basis of psychological tests. Sometimes these two methods are combined.

Industrial psychologists are concerned with trying to develop tests that will enable them to predict accurately which employees or job applicants are most likely to have accidents. A step toward this goal was made in a recent study conducted on 104 commercial truck drivers. The purpose of the investigation was to determine what personality, sensory, or personal history factors might be predictive of a high accident rate in that job.

Each driver was administered a large battery of tests. When the results were correlated with the

number of accidents each driver had per five thousand miles, it was found—as might be expected—that good visual acuity and depth perception were two factors significantly correlated with low accident rate. Drivers who were married, who scored high in mechanical interest on the Kuder Preference Test, and who did well on an emotional stability test were found to have fewer accidents than their opposites. On the other hand, drivers who scored high in artistic and literary interests on the Kuder test tended to have a greater number of accidents than average (Parker, 1953).

Accident proneness also seems related to whether or not workers are happy in their jobs. This fact was brought out indirectly in a study of the relationship between industrial accidents and absenteeism.

In the situation studied it was found that accidents were negatively associated with absences that had been excused ahead of time, but positively correlated with voluntary "no reason" absences. Since people who are happy in their jobs are seldom absent unless necessary, the fact that accidents are so highly correlated with "no reason" absences would seem to indicate that some accidents may be a form of protest against the job or withdrawal from it (Hill and Trist, 1953).

Other studies also seem to indicate that workers who are happy in their jobs are least accident prone. A study of ninety steel-mill workers showed, for example, that the workers who had the fewest accidents were those who were best liked by their fellow workers (Speroff and Kerr, 1952). Perhaps skill in dealing with people is positively related to skill in avoiding accidents. Or perhaps workers who feel rejected by their fellow workers do not concentrate well on their work. In any event, this study suggests that allowing employees to choose congenial working companions might act as a safety device.

Finally, a study of more than fifty departments in one factory indicated that the departments with the most accidents were those in which employees seldom were promoted, seldom submitted suggestions, and seldom had an incentive system (Kerr, 1950). Thus it would appear desirable from a safety standpoint, as well as for other reasons, to provide a "psychological work environment that rewards the worker emotionally for being alert, for seeking to contribute suggestions,

for passing a tip to a co-worker on how best to do something or how not to get hurt."

S U M M A R Y

Many problems in employer-employee relationships can be solved by the application of sound principles of vocational and employment psychology. The person choosing a job must consider *what the job requires* in education, intelligence, physical ability, special abilities, temperament, and interests; *what satisfactions it offers* to meet his own personality needs; and *what opportunities it presents* not only at the present time but also for the future.

Steadily growing in importance are psychological tests, conducted by experts, for *personnel selection*. There are six critical steps in creating tests of assured validity: (1) establishing criteria of proficiency in job performance, (2) analyzing the job to determine required abilities and traits, (3) selecting tests that measure the abilities and traits, (4) checking each test to see if it has differentiated between successful and unsuccessful applicants, (5) establishing job ability standards in terms of test scores, and (6) testing all new applicants but hiring only those who meet the standards. In setting standards for high level jobs, the psychologist must depend to some extent on *clinical insight*.

Because subjective factors of personality and temperament are important, psychologists have worked to create tests that make impossible the faking common on conventional *self-inventories*. Two of the most successful are the *Gordon Personal Profile* or *forced-choice* test and the *Edwards Personality Preference Schedule*. The value of *situational tests* has not yet been fully determined.

When they are the result of rigid analysis, *standardized application blanks* can have important predictive value. A carefully *standardized personal interview* can also be an effective selection device.

Most studies indicate that *older workers* can be used in business and industry without reducing production if the employer takes special care to fit the worker to the job. Similarly, *handicapped workers* have repeat-

edly shown themselves to be valuable employees.

To gain greater insight into the needs of employees as human beings, present-day industry is turning increasingly to training in *human relations*. In the human relations laboratory, itself a sort of experimental community, *content groups* discuss specific employee problems, and *process groups* study the actual operation or dynamics of the group as a whole.

Correctives for the *industrial monotony* common in much factory work include (1) selecting the right workers, (2) scheduling rest periods, (3) allowing social contacts, (4) planning after-work activities, (5) showing how the job is important, (6) building pride in the company, and (7) building identity with the enterprise system. Management can help satisfy employees' "need to belong"—and at the same time increase production—by encouraging teamwork. Two-way communication can be achieved through employee opinion polls, natural leaders in the work force, and the written or printed word, which must be made readily understandable to the worker. Free communication with some member of management also serves as a simple form of psychotherapy for the employee.

Planning of work space and equipment which takes into account the human component in a man-machine system is called *human engineering* or *engineering psychology*. Equipment arrangement should be based on the various *links* in such a system. In designing any control for technological apparatus, the engineer must consider the *force* necessary for operation; he must see to it that the control is easily identifiable; and he must take into account *realism*, or naturalness of operation.

Industrial psychologists have helped reduce on-the-job accidents by isolating many of the factors responsible. *Safety devices* are effective if they are foolproof, if they are constructed so that they have to be used, and if they are made acceptable to workers. Proper *atmospheric conditions* and *illumination* are important aids to safety. Production rate, age, and experience all may play a part in accidents, and studies have shown that some individuals are *accident prone*. Other studies seem to indicate that workers who are happy in their jobs are least prone to accidents.

THE BRAIN AND NERVOUS SYSTEM

CAREERS IN PSYCHOLOGY

FRONTIERS IN PSYCHOLOGY

SECTION ONE

THE BRAIN AND NERVOUS



AN OVERALL VIEW

COMPONENTS OF NEURAL FUNCTIONING

THE BRAIN

THE NERVOUS SYSTEM IN EMOTION



Underlying every thought, every perception, and every action is a pattern of neural activity. As we encounter stimulus situations of all kinds, messages are received, evaluated, integrated, and stored, and other messages are sent out to the various organs of response. Clearly, any complete understanding of man's behavior must include an understanding of the neural mechanisms underlying these activities.

Neurology, like psychology, is a relatively young science. Most of what we know about the nervous system and its functioning has been learned in the last hundred years, and there are still vast realms to be explored and charted. But though today's knowledge is far from complete, important progress has been made in identifying the important neural structures and in discovering how they function as we think and feel and move. The present chapter will summarize some of the findings about neural activity that have special relevance for the problems of psychology.

AN OVERALL VIEW

The nervous system is a complex structure. As you try to grasp the essential concepts in regard to its form and functioning, it will be easy to get lost in the maze of details that must be given for an adequate picture. Accordingly, to give you the thread of the discussion to come, the main points that will be made are listed here. It is recommended that you reread this summary after finishing the chapter.

1. The *neuron* is the structural unit of the nervous system. The neuron, or single nerve cell, has all the characteristics of living cells in general and is in addition specialized for irritability and conductivity. The neurons correspond roughly to the single wires of a telephone system. Each neuron has a nucleus situated in the central nervous system or in a nerve center and an elongated part which runs either in the central nervous system or in nerve trunks.

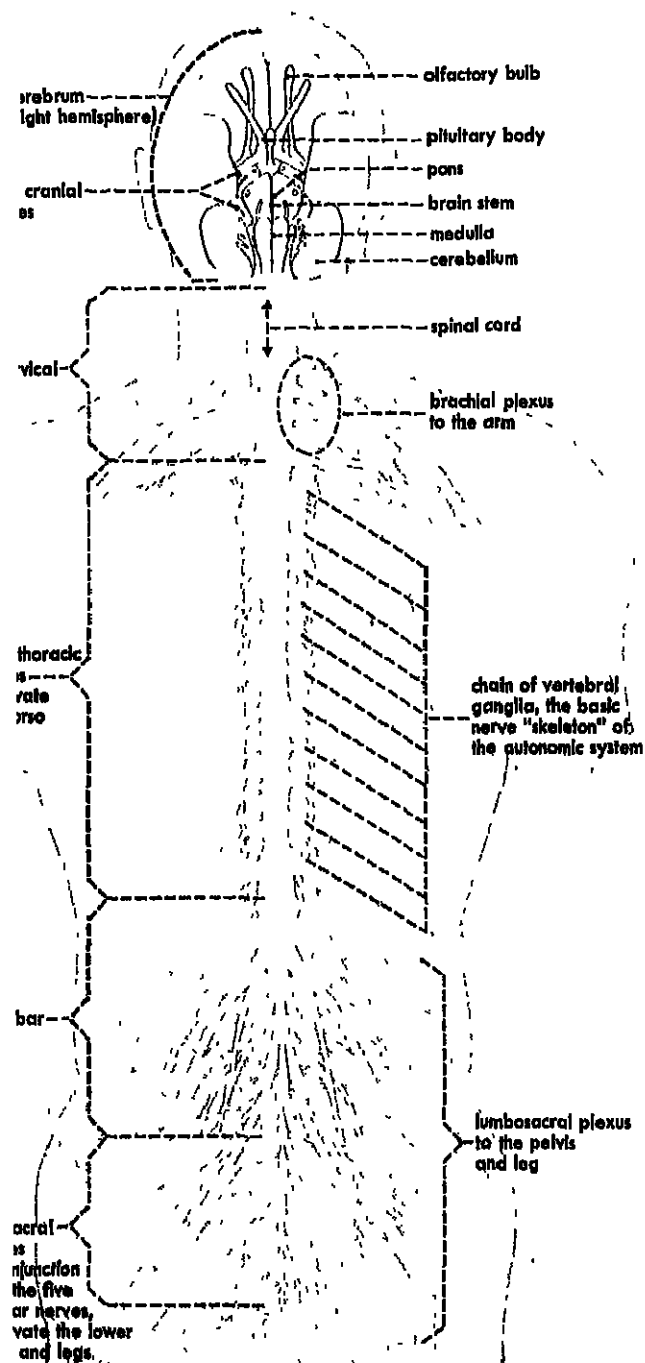
2. *Nerves* or *nerve trunks* are larger structural units in the nervous system. They con-

sist of the long extensions or fibers of numerous neurons, joined into one bundle. Sensory and motor fibers are found in the same nerve.

3. The receptor-connector-effector process operates through the passage of *nerve impulses* (electro-chemical excitations) along the neurons.

4. The *sensory-motor arc* is the functional unit of the nervous system. Nerve cells are linked in chains of two or more to connect receptor cells with cells in some organ of response. A typical chain consists of a receptor neuron, a correlation neuron within the spinal cord or the brain, and an effector neuron. A sensory-motor arc is also called a *reflex arc* because the impulses going to the central nervous system are "reflected" back to muscles, often muscles near the sense organ.

5. Much of the work of the nervous system is done by the *correlation neurons*. Through them a sense organ can be connected with many effector neurons and many muscles. They make a distributing system. Long corre-



The Central Nervous System

The various components of the central nervous system, which is involved in our sensory and motor activity, are shown schematically above. The brain is drawn as it would appear if it were rotated backwards in the skull cavity and looked at from the front. This view enables you to observe the connection of the spinal cord to the old brain and the old brain's connection with the cerebrum.

lation neurons can carry messages up to the brain for correlation at "headquarters;" and others carry messages back down to the muscles and glands. The neurons carrying these messages up and down form *nerve pathways* or *tracts*. To understand them it is necessary to know about the spinal cord and brain.

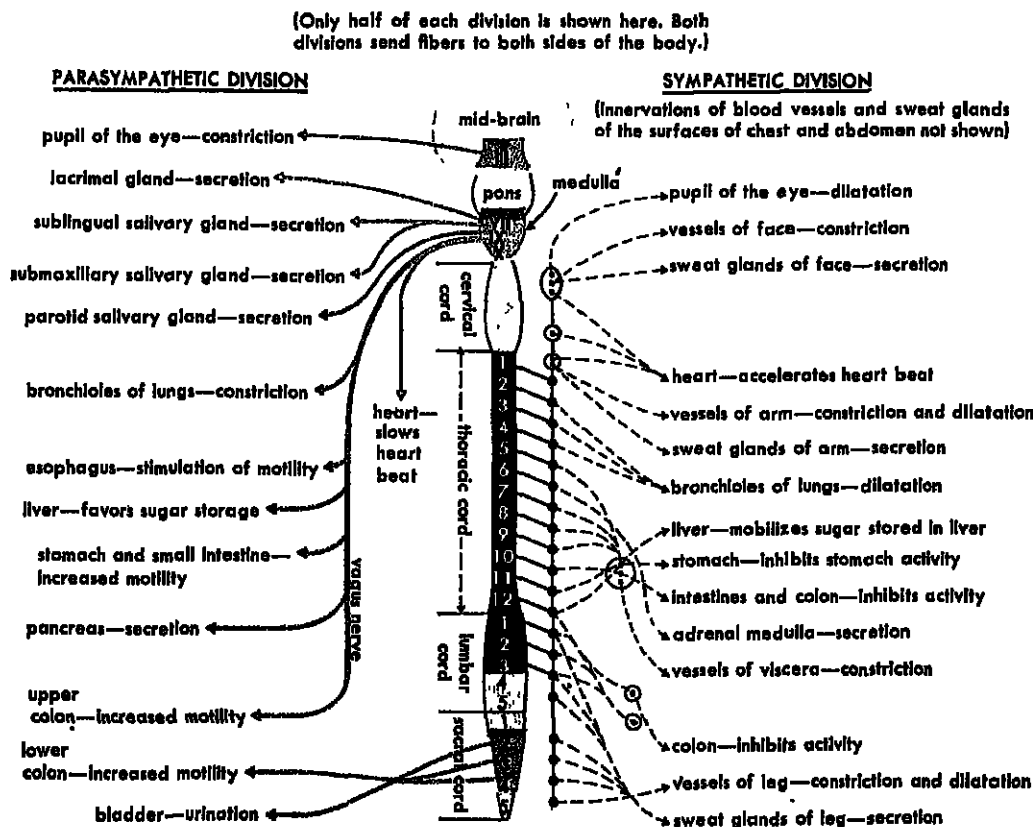
6. The nervous system as a whole has two parts: the central and the peripheral. The central nervous system, as it is called, (or, strictly speaking, the central part of the nervous system) is made up of the brain and spinal cord. Its function is to correlate and integrate to make the various parts of the body work together as a good team should.
7. The peripheral nervous system (or, strictly, the peripheral part of the nervous system) consists of nerve fibers passing from the receptors to the central nervous system and of fibers passing from the central nervous system to muscles and glands. These peripheral nerves thus connect the central nervous system with all the receptors and effectors throughout the body. The central nervous system and the stumps of the peripheral system are shown in the drawing at the left.

Both the central and the peripheral nervous systems have parts which control two kinds of functions: both contain *somatic* components, which control the skeletal muscles, and *visceral* components, which control the glands and the special kind of muscle found in the blood vessels, eyes, and internal organs, or *viscera*. In general, the somatic muscles can be consciously controlled, whereas the visceral ones cannot.

In the central nervous system, these somatic and visceral components are largely intermingled, but in the peripheral nervous system, they are partly distinct, and it is the visceral portion of the peripheral system which is called the *autonomic nervous system*.

As is indicated in the drawing at the top of page 481, the autonomic system includes fibers going to and from the various internal organs as well as to the sweat glands, muscles of the blood vessels, and so on. Some of the correlating work of the autonomic system is done in the *sympathetic chain*—a chain of ganglia (nerve centers) lying just outside the spinal cord—or in networks near the internal organs. The two parts of the autonomic system—the *sympathetic* and the *parasympathetic*—originate from different sections of the brain stem and spinal cord, as shown in the

e Autonomic Nervous System



drawing, and, in general, oppose each other's functions. The way in which they act together in the body is discussed in some detail on pages 499-502.

7. The nervous system functions at three levels of complexity:

(a) Simple, unconscious processes, such as the reflexes, are possible through connections located in the spinal cord and an extension of it known as the *brain stem* (page 480).

(b) More complex processes, such as standing, walking, and breathing, are made possible by the brain stem, which sends messages to the spinal cord. The *cerebellum* and the *pons* (page 480) control equilibrium and aid the cerebral cortex in carrying out smooth, well-coordinated, voluntary movements; the *thalamus* transmits sensory impulses to the cerebral cortex; and the *hypothalamus* plays an important role in emotion and temperature regulation (page 500). This part of the brain is

sometimes called the *old brain* because it was the first to develop in the course of evolution.

(c) Sensation, voluntary movements, learning, thinking, and other complex behavior are carried out by the *cerebrum*, or *new brain*, (page 480) particularly the *cerebral cortex*.

This chapter will discuss the components of neural functioning, the functions of different parts of the brain, and the functioning of the nervous system in emotion.

COMPONENTS OF NEURAL FUNCTIONING

In this section we shall describe first the basic structures of the nervous system—the neurons and the sensory-motor combinations

of neurons—and second the manner of functioning of these structures—the characteristics of nerve impulses and the laws of their operation.

THE NEURON

The “building block” of the nervous system is the single nerve cell, the neuron. Like all other cells, it is made up of protoplasm (living substance) surrounded by a thin, living membrane.

Anatomy of the neuron. Each neuron has a *cell body*, a thickened portion containing a *nucleus*. Under the microscope this nucleus can be seen in tissue that has been imbedded in wax, cut in very thin slices, and colored with certain dyes. Any portion of a neuron which is cut off from its nucleus will die and disintegrate. Anatomists map the pathways of the nervous system by destroying the part of the neuron containing the nucleus and then, with the aid of a microscope, tracing the degeneration of the neuron wherever it goes throughout the nervous system. The degeneration stops at the end of the neuron, indicating the validity of our considering it as the structural unit of the nervous system.

At each end of the cell body are slender extensions, or *nerve fibers*. The fibers at one end are the *dendrites*; those at the other end are the *axons*. Dendrites are highly branched, usually quite short fibers. They are the re-

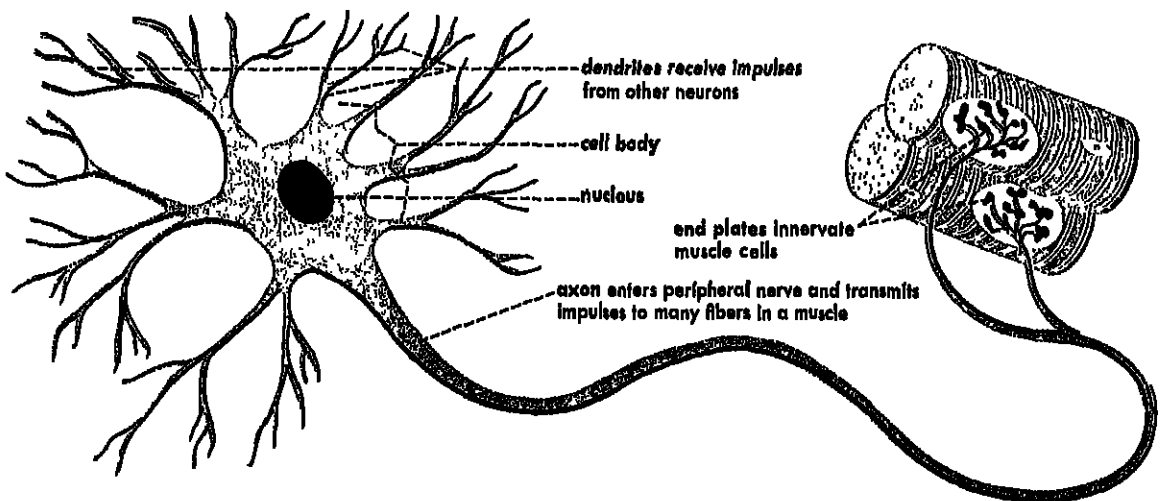
ceiving mechanisms of the nerve cell, taking in impulses from other neurons or from receptor cells. The axons terminate in *end brushes*. (Those in motor neurons are usually called end plates.)

Kinds of neurons. Neurons vary widely in size and shape, depending upon the function they perform and the distance they extend. On the basis of function, neurons are divided into two classes. The *long-conducting neurons* make up the peripheral nerves and the pathways of the central nervous system. These have long, single axons or long dendrites. All the sensory and motor fibers are of this type.

The *correlating neurons* have many short dendrites and axons, the latter often giving off branches called *collaterals*. The whole effect is to provide many connections, or alternative pathways. The central nervous system contains both types; the peripheral system has only long-conducting neurons.

Myelination of fibers. The axons and collaterals of large diameter are surrounded by a fatty white covering known as the *myelin sheath*, while the thinnest ones tend to be unmyelinated. Not all the pathways are myelinated at birth, and, for some unknown reason, nerve fibers which are destined to become myelinated do not function until their myelin sheath is formed. This probably explains why infants cannot carry out many activities. Myelination is part of the maturation that must take place.

Motor Neuron



NEURAL IMPULSES

Nerve fibers are round, long, and thin like wires, and nerve impulses can be detected with electrical recorders. But a nerve impulse differs from electric current in several important respects:

1. Electric current flows with the speed of light (millions of yards per second) while some nerve impulses travel about one yard a second—only a tenth as fast as a good sprinter can run.

2. An electric current passing through a wire peters out, especially in a wire that has high resistance, and never regains its original strength even in going through a piece of low-resistance wire; a nerve impulse, on the other hand, may get weak going through a segment of nerve poisoned by alcohol fumes but comes back to original strength when it hits a normal nerve. Thus if a wire and a nerve were stretched around the world and an "impulse" started in each, the impulse in the wire would become infinitesimally small, whereas the impulse in the nerve would be the same at the end as it was at the start.

3. A wire can conduct thousands of impulses per second, as in a telephone wire, but nerve fibers can conduct only several hundred per second and then only for a short time. No matter how fast the stimuli come, impulses can be set up only so often. After each impulse a nerve cannot fire again for a time even in response to strong stimuli: it is

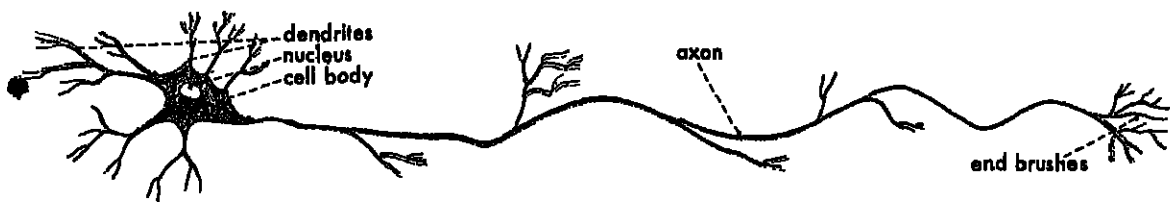
said to be *absolutely refractory*. A bit later it becomes first oversensitive, then undersensitive, then normal again.

4. A small battery attached to a wire will give a small current in the wire; a larger battery, a larger current. But a nerve impulse does not vary in size. If a nerve responds at all, it responds in full. A small electric shock gives no impulse; increase the shock step by step, still no impulse. Then, suddenly, some small increase produces a nerve impulse, one which is fully as large as if the shock were many times stronger. This is the "all-or-none" principle. Each nerve has a *threshold* below which it is unexcitable; all stimuli above the threshold produce a full response.

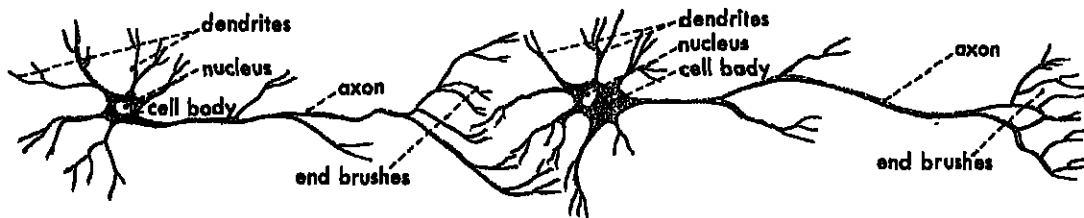
This all-or-nothing characteristic raises puzzling questions, for we all know from our experience that our sensations *do* vary in strength. Apparently there is a double explanation for this. First, the stronger a stimulus, the shorter the refractory phase will be and the sooner each impulse will follow the preceding one; thus the stronger the stimulus the more impulses will be sent in a given period of time. And, second, fibers differ in their thresholds: the stronger the stimulus, the more fibers will be aroused. Thus the strength of the sensation varies with the frequency at which fibers send impulses and the number of fibers involved, even though the strength of each fiber's responses remains constant.

Nerves and fuses. Physiologists liken the nerve impulse conduction to a chain of fire

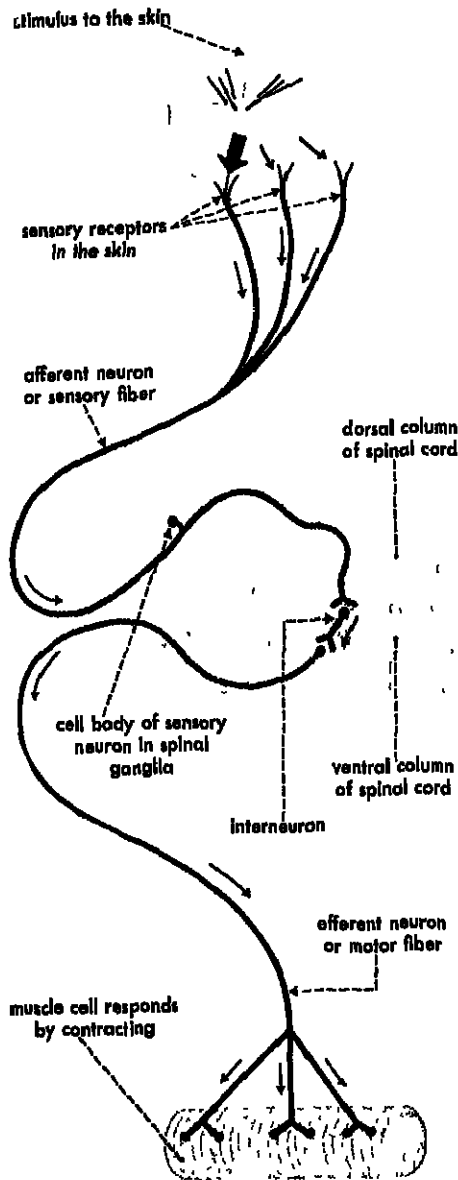
Long-Conducting Neuron



Correlating Neurons



A Typical Sensory-Motor (Reflex) Arc



A typical reflex is set in motion by a sensory stimulus. A "nerve impulse" travels through the dorsal nerve root of the spinal cord, through an interneuron in the grey matter of the spinal cord, out along a motor fiber in the ventral (forward) root, and then to the muscle, which contracts. This is the body's simplest protective device.

sweeping along the fuse of a firecracker; the stimulus is like a match. The nerve impulse, like fire traveling along a fuse, needs little energy to start, has energy for conduction supplied all the way along, and releases a great deal of energy in the muscles and glands that it activates. This is unlike the conduction of electrical impulses or light or sound waves, where the energy that emerges at the far end is only the energy put in at the beginning, minus what is lost along the way.

The analogy of the fuse is not complete, however. For one thing, the nerve is self-restoring afterward, whereas a fuse, of course, is not. And the actual transmission of energy is somewhat different. In a fuse it is a simple chemical (oxidative) process whereby each segment excites the next by heating it up to the flash point. In the nerve it is an electrochemical process; the energy comes from slow oxidation (metabolism) and is stored up by charging the outer film of the nerve like the plates of a condenser. Thus the inside and outside at each point along the nerve are like two poles of a battery. If the stimulus breaks down the insulation at any point, it causes the next segment, acting like a battery, to discharge through the low resistance. This causes the insulation to break down at the next point, and so on along the nerve. During the refractory period, the insulation is restored and the "battery" is recharged.

✓ Ways of studying the nerve impulse. Although the nerve impulse is not a simple electric current, its passage along a fiber does give rise to measurable electric currents which give physiologists important clues in their study of conditions influencing the passage of nerve impulses. The general procedure is to attach to a nerve the two electrodes of an amplifying system similar to the kind used in radios. The tiny electric currents set up by the impulse are recorded by means of instruments like the electroencephalograph. In the latter case the patient sits or lies in a relaxed position with the electrodes from the machine placed on his head. The electric currents set up by the nerve impulses in the brain are magnified and recorded automatically on a strip of paper. (See pages 154 and 339.)

THE SENSORY-MOTOR ARC

In a sensory-motor arc one neuron possesses at one end endings which are sensitive

to stimulation from the outer world (or which connect with a *receptor cell*—a cell which does have this sensitivity). This neuron is called a *sensory*, or *afferent*, neuron because it carries the nerve message *toward* the center (*afferent* is from two Latin words: *ad*, meaning "toward," and *fero*, meaning "carry"). Another neuron connects with the first either directly or indirectly and terminates in some organ of response. It is called the motor, or *efferent*, neuron because it leads the nerve message *away from* the center or point of connection (*efferent* is from *ex* and *fero*, meaning "away from" and "carry"). In the simplest sensory-motor arcs there are only these two neurons, but in most sensory-motor arcs the sensory and motor neurons are linked by one or more correlation neurons, sometimes called *interneurons*.

The drawing at the left shows a sensory-motor arc with the simplest interneuron; more complicated ones, with collaterals, can be seen in the drawing at right. What do these "extra" neurons do? Two-neuron sensory-motor arcs can cause a local response, but if you pinch a baby's toe, the whole leg draws up, not just the toe. A correlation neuron acts as a distributing system like the wiring in a house. Through it a single afferent fiber can send messages to many outgoing, or efferent, fibers up and down the spinal cord and cause many muscles to respond. The sensory neuron itself, by sending a branch up and down the spinal cord and giving off collaterals, also acts as a distributing system.

The collaterals and interneurons correlate in still another way. They bring impulses from widely distributed sense organs to the same efferent neuron much like a funnel. This makes for economy, since one muscle fiber can take part in many different reflexes.

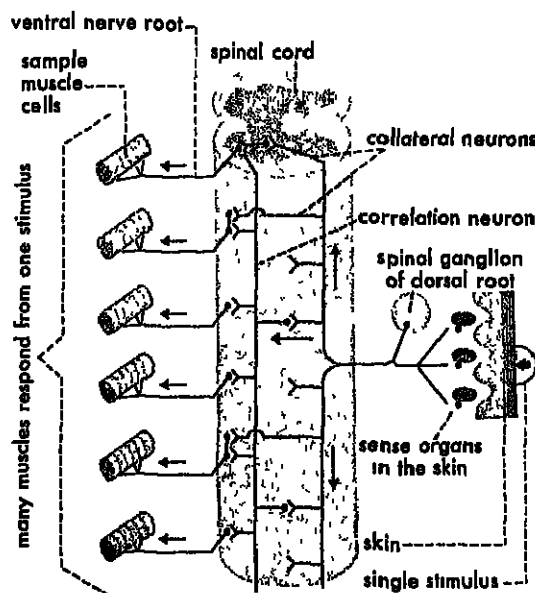
Some chains of correlation neurons are arranged in self-exciting circuits which work as follows: When a neuron discharges, the nerve impulse passes down the main axon and also into a collateral branching off from it. The side-branch may connect with a second neuron, causing it to be excited. The axon of the second neuron will in turn transmit the impulse to the original cell and excite it a second time. This will be repeated many times. Such self-exciting circuits explain why a momentary stimulus can cause a response which continues long after the stimulus has been withdrawn. A *two-neuron arc cannot do this*.

Still other chains of correlation neurons form long circuits which carry impulses to the brain. These keep the "headquarters" in the brain informed of what is going on, and the brain may then modify the activity of the simple reflex arcs.

Thus correlating neurons do four things: (1) enable impulses from a single receptor to reach many muscles, (2) permit the same muscle to be used in different reflexes, (3) permit a short-lasting stimulus to produce a long-lasting response, and (4) cause impulses to be long-circuited to the brain.

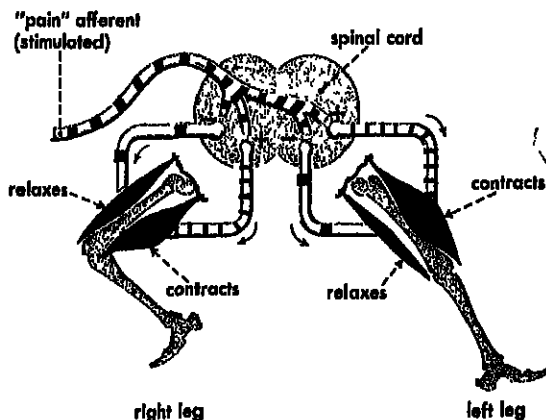
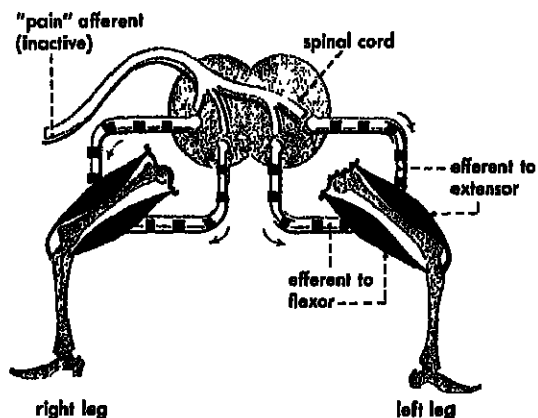
The *synapse*. Nerve cells do not join each other physically as do lengths of pipe. The axon branches which make up the end brushes of one neuron sometimes terminate in rounded expansions applied against the dendrites of the following neuron and sometimes even intertwine with them, but there is no protoplasmic bridge between the two cell walls. This type of association without direct contact is called the *synapse*. As the nerve impulses pass across a synapse between two neurons, there is a lag in their rate of travel. Some impulses never cross the synapse at all.

Correlation Neuron



A single stimulus rarely if ever produces a single response. Collateral fibers and correlation neurons relay impulses to many parts of the body.

Inhibition and Reciprocal Innervation



At left, the flexor and extensor muscles of both legs are shown in a normal state of contraction produced by a constant stream of efferent nerve impulses. At right, we see what happens when a pain afferent from the right leg is stimulated. A reflex occurs which stimulates the flexor in the right leg and the extensor in the left. At the same time there is a decrease in the nerve impulses to the efferents of the extensor in the right leg and the flexor in the left. Arrows indicate direction of transmission of nerve impulses. Plus signs indicate stimulating action; minus signs show inhibiting action.

From Carlson and Johnson, 1941, page 408. Used by permission.

The way a nerve impulse "jumps" from one cell to another across the synapse has been in dispute for many years. Most physiologists today believe that the electrical activity connected with nerve impulses excites the next neuron in the chain in the same way that an electrical stimulus from a battery excites a nerve fiber. Some, on the other hand, believe that the terminals of the nerve fiber produce a chemical substance, called acetylcholine, which stimulates the next neuron. Whichever is true, the impulse jumps so fast that only the electrical aspect can be studied.

One fact that is generally accepted is that the synapse serves as a one-way valve. Although the impulse will travel in both directions within a neuron, nerve impulses cross the synapse only from end brush to dendrites—never in the opposite direction.

Alternative nerve pathways. Hundreds of nerve fibers are involved in the simplest stimulus-response act. Each sensory-motor arc is duplicated many times. Often the duplicate connections lie side by side, but there are numerous instances in which the duplicates take quite a different course in going through the nervous system from the receptors of the sense organs to the effectors. This is because the dendrites of most neurons form

synapse connections with the axons of many other neurons.

The great number of potential pathways makes possible a variability of response to identical stimuli. The brain is especially rich in such alternatives. Thus, unlike the responses of the spinal cord, which are fairly stereotyped, those of the brain are capable of almost infinite modification.

Experiments which will be described presently show that injuries to certain parts of the brain need not bring permanent disability, for other areas are capable of taking over the lost function. This fact makes possible the re-education of individuals who have become partially paralyzed or insensitive through the impairment of a specific part of the brain.

SPINAL REFLEX ACTION

Spinal reflex action—that is, stimulus-response behavior which can be studied by separating the spinal cord from centers of correlation in the old brain—is better understood than the more complex reaction involving the higher centers, but we may suppose that many principles established for reflex action will be found to hold for responses involving the higher centers.

Inhibition and reciprocal innervation. In general, the muscles of the body are arranged opposite one another in antagonistic pairs, one extending and one bending or flexing a given joint. When one muscle contracts, its antagonist relaxes, for the reflex *excitation* of one is accompanied by the *inhibition* of the motor neurons supplying the other. Without this mechanism, antagonist muscles would, as it were, be "trying" to do different things at the same time, which might result in no movement being accomplished—a stalemate. Because of this mechanism an arm or a leg can do "one main thing at a time." This is known as the *law of reciprocal innervation*. It is illustrated on page 486.

Inhibition occurs at synapses and makes a neuron less excitable to other incoming impulses. One reflex can inhibit another, as in reciprocal innervation, and the higher centers can inhibit motor neurons or lower centers.

How does the nervous system select one response over another when there is a condition of conflicting stimulation? There are three characteristics of the stimulus which give advantage to one impulse over another in the competition for dominance in the organism's activity.

1. Painful stimuli usually have the right of way. The organism is innately organized to let the important business of self-protection come first.
2. Strong stimuli or repeated weak stimuli have the right of way.
3. Too frequent repetition of a response will give the right of way to a rival response through fatigue and adaptation.

Adaptive character. Reflexes usually perform some movement or glandular response which is obviously of service to the organism. Withdrawal of a limb when it is injured protects it from further injury and is therefore termed a *protective reflex*. Tears induced by a fleck of dust wash it out of the eye. Such examples can be multiplied many times. Some reflexes, such as swallowing, are necessary for vital functions of nutrition; others, like blinking and sneezing, are involved in many of our daily activities.

Localization. If a stimulus is to elicit a reflex response from any given part of the body, it must be applied to a fairly well circumscribed area of the body. Many of the simple protective reflexes involve action at the same

part of the body as that which is stimulated. For example, when one leg is pinched, it is that leg which is withdrawn. In the struggle for existence, those organisms survived which were equipped with specific reflexes adequate to protect the body from injury.

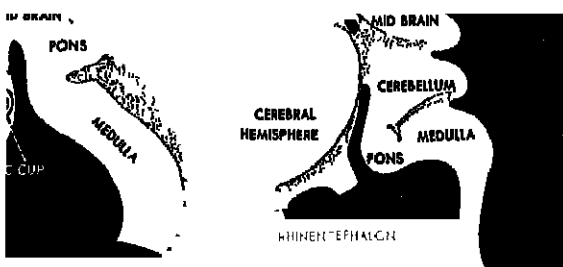
Reaction time. Even the simplest reflexes do not occur instantaneously. The delay between the presentation of the stimulus and the execution of a response is made up of the time required for the sensory nerve ending to be aroused and for nerves to conduct, plus the time that is lost at the synapse and time required for the responding muscles to contract or glands to secrete. The more synapses involved in a stimulus-response act, the greater the reaction time for that act. But reflex actions as a whole are very quick, much quicker than voluntary actions controlled by the brain. In fact, protective reflexes are frequently performed so quickly that the adaptive withdrawal is complete before one becomes aware of the stimulus and its danger.

Duration of response. A stimulus lasting a fraction of a second often causes the motor neurons to discharge for several seconds or even minutes. This happens, as we have seen, because impulses traveling in circular chains of neurons or through long-circuit chains and self-exciting circuits continue to reach the motor neurons long after those which took the shortest path.

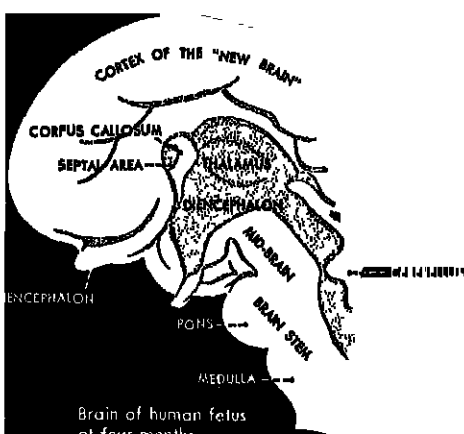
Irradiation. If the strength of the reflex stimulus is increased, the number of muscles coming into play is increased. The area in which fibers respond is also widened. Lightly scratch the sole of a baby's foot, and the toes alone will move; pinch the foot and the whole leg will be sharply retracted; a stronger pinch may produce a response of the entire body. As more sensory fibers are activated, more correlation neurons come into play, leading to stimulation of more motor neurons.

Summation. If a very weak stimulus is repeated, the reflex response may eventually take place even though a single presentation of the same stimulus is ineffective. Although the few afferent fibers excited by a weak stimulus are unable to excite even one spinal neuron, with repetition there is a summation of effects which causes a reflex response.

Such *temporal summation* is easily shown on a pet dog. If one lightly scratches the dog's side, no scratch reflex results. But if the same



Brain of human embryo at nine weeks



Brain of human fetus at four months

Pre-Birth Development of the Brain

These three stages of embryonic development of the human brain also serve to indicate the course of the brain's evolution, which is toward ever greater growth of the forward part relative to the older structures. As the cerebral hemispheres become larger and larger and crowd against the skull, more and deeper convolutions appear in the surface.

scratch is repeated several times in rapid succession, the hind foot of the dog will start to scratch. The weak stimuli have summated.

Summation also occurs when two different but adjacent points on the skin are stimulated. Each stimulus alone may cause no reflex response, but when the two points are stimulated at the same time a reflex results. This is called *spatial summation* because different points, and hence different afferent nerve fibers, are involved. Spatial summation is further proof of what the microscope shows—that correlating neurons collect the impulses from many afferent fibers to excite a single outgoing fiber.

A third type of summation is the summation of impulses from higher centers with those of a local reflex arc. For example, the knee jerk

reflex is stronger if the subject clenches his fist just before his kneecap tendon is struck. Summation of any kind is possible only because of synapses and correlating neurons. If the reflex arcs were isolated from one another, they could not affect each other at all.

In man the brain can inhibit up to a certain point the protective reflex actions of the spinal cord. Strong drives can take precedence over pain reflexes, and we can voluntarily suppress pain responses and the blink reflex. These and other functions of the brain will be considered in the next part of the chapter.

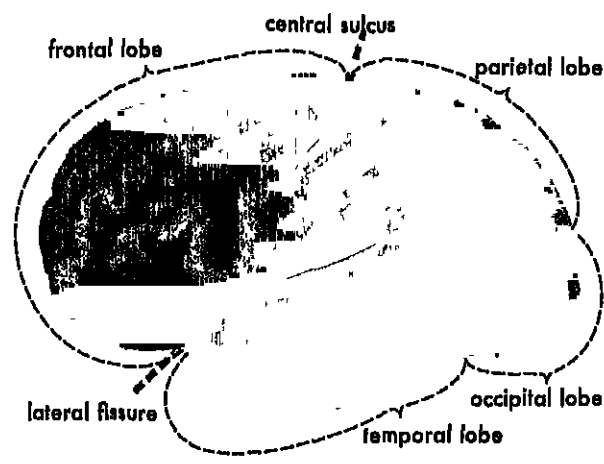
THE BRAIN

In the last analysis the superiority of man over lower animals derives from his superior ability to think and plan, utilizing objects both present and absent in overcoming his problems. This ability is made possible by a larger, more complex brain, which operates with intricate division of labor and with more control over the rest of the nervous system than we find in any of the lower animals. Perception, thought, consciousness itself depend on the brain for their occurrence.

MAIN PARTS OF THE BRAIN

The main part of the brain—the *cerebrum*—is divided into two halves called the right and left *hemispheres*. When seen from above, it looks something like a shelled walnut (page

Lobes of the Left Cerebral Hemisphere



478). Each hemisphere is essentially a mirror image of the other. That is to say, a sketch of one side would look like one of the other side seen in a mirror. In general, the *left* hemisphere controls the *right* side of the body, while the *right* hemisphere controls the *left*.

Each hemisphere of the cerebrum has four parts, or *lobes*, and two deep grooves known as the *fissure of Rolando*, or *central sulcus*, and the *fissure of Sylvius*, or *lateral fissure*, in addition to many smaller grooves formed by the convolutions of the surface. The drawing on page 488 shows these parts:

1. The *frontal lobe*, located in front of the nearly vertical fissure of Rolando and above the fissure of Sylvius.
2. The *parietal lobe*, still above the fissure of Sylvius but back of the fissure of Rolando.
3. The *temporal lobe*, separated from the frontal and parietal lobes by the fissure of Sylvius and so named because it lies just beneath the temples.
4. The *occipital lobe*, located at the back of the brain.

Study these main divisions of the cerebrum until you are thoroughly familiar with the location of each.

If we examine cross sections of the brain with the naked eye, we see that there is a narrow, grayish rind of tissue covering the cerebrum. This is the *cortex* (which means "bark"). It is made up largely of the dendrites and cell bodies of neurons whose axons extend into the interior section. (See page 478.)

Examining the center of the section, we find that it comprises by far the larger portion of the brain. It is almost white in color, the whiteness resulting from the presence of the white myelin sheaths of countless nerve fibers. (See page 482.) Studies have shown that these fibers are of several different sorts. Some are sensory fibers coming up from the spinal cord by way of relay centers in the old brain; some are motor fibers going down to the spinal cord; others connect one area of the cortex with another area of the same hemisphere; and still others connect with areas on the opposite side. The drawing at the top of page 494 shows the connections made by the various types of association fibers in the interior of the brain.

What are the roles of the various parts of the brain described above? How is the work divided among them? The brain performs the function of a central control tower. Im-

pulses from incoming neurons are shunted back and forth in the brain as the brain analyzes the new information, puts it together (also stores some of it), and eventually sends appropriate messages to organs of response.

HOW NEUROLOGISTS STUDY

THE WORK OF THE BRAIN

There are several recognized methods of studying the functioning of the various parts of the brain. The most important ones will be reviewed briefly here.

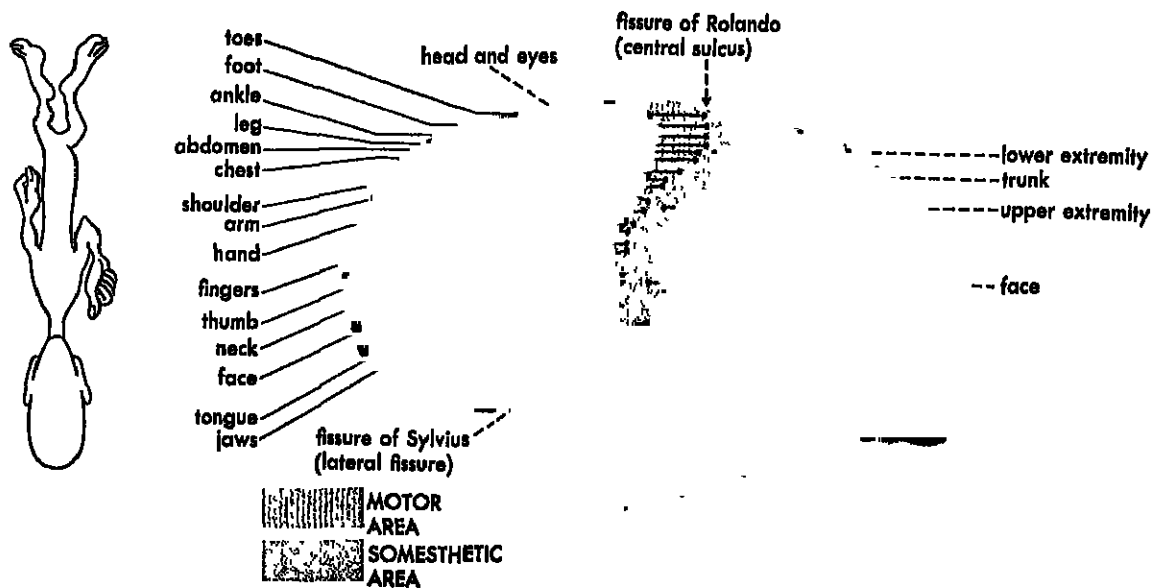
The anatomical method. The brain can be treated in such a way that nerve pathways can be traced under the microscope. In this way, the anatomist early learned what sense organs sent fibers where and what parts of the brain sent motor fibers to the spinal cord. The anatomist has seen hundreds of connections for which the physiologist has not yet been able to figure out a purpose. It is as though a jungle native were given a television set: he could see where the wires went, but it would be a long time before he could understand the functions of condensers, vacuum tubes, and the various circuits.

The method of extirpation. To *extirpate* means to cut out or destroy. The neurophysiologist uses the method of destruction systematically with animals. The behavior of an animal is first carefully observed and measured. Next the scientist cuts away part of the brain and observes how the behavior is changed. Such observation can be made freely with animals, but with man, only when disease, accidents, or war wounds have destroyed parts of the nervous system. In such cases, of course, the parts destroyed are seldom sharply localized, and in general observation leads to less clear results than can be derived from cases involving deliberately placed injuries to the animal's brain. Such injuries, whether induced by experiment or by accident, are referred to as *lesions*.

When a certain bit of behavior disappears or becomes exaggerated or modified after the loss of a portion of the nervous system, the neurologist concludes that that portion is essential to the normal performance. Such observations do not imply that the area destroyed has the sole responsibility for the behavior in question.

The action-current method. We know that neurons produce electric currents when they

Localization of Motor and Somesthetic Function in the Cerebral Cortex



Certain areas of the brain have been found to be associated with specific types of sensation and activity, as shown in the diagram above. The area of the cortex just in front of the fissure of Rolando is the area that produces muscular activity in the various parts of the body. Stimulation of points in this area produces activity in the parts of the body indicated at the left. The body is represented upside down, with the feet controlled by the upper part of the area, the head by the bottom part. The size of the area in the cortex corresponds with the complexity of movement rather than with the size of the body area; thus the hand is controlled by an area larger than that controlling the entire group of leg muscles. The somesthetic or body-sensitivity area, located just across the fissure from the motor area, is activated by messages from the sensory receptors of the skin. It also represents the body upside down and in proportion to the complexity of function rather than to the size of the body area.

conduct and that the cerebral cortex gives out rhythmical waves which can be analyzed for frequency and amplitude. By correlating the areas of greatest electrical activity with the nature of the stimulus at a given moment and the type of activity being carried out, we can make considerable progress in determining which areas of the brain are involved in various types of sensations and activities.

The method of stimulation. The areas of the brain necessary to sensation can be mapped by stimulating the brains of patients during surgical operations and obtaining introspective reports on the sensations they experience.

Areas related to muscular activity can be mapped by stimulating different parts of the brain and watching to see which parts of the body move. The experimenter usually uses a weak electric current but sometimes a chemical, especially strychnine. In this way he can correlate exact spots in the brain with particular muscle groups.

LOCALIZATION OF FUNCTION IN THE CEREBRUM

What are the neural correlates of our experiences of sight and sound and smell and

touch? Does it take different kinds of nerves to conduct different kinds of sensory messages?

Over a hundred years ago, Johannes Muller put forth the doctrine of "specific nerve energies." According to this doctrine a sensory nerve will produce a certain type of experience no matter how it is stimulated. Close your eyes and press upon the lids. In a moment you will see a wealth of color and design, *yet the stimulus is not light but pressure*. When the cut ends of the nerves in the healing stump of an amputated leg are stretched, the patient sometimes reports sensations of pain, itch, or even movement in the toes that are no longer a part of his body. If a person is struck on the back of the head over the visual area of the brain, he "sees stars"; that is, the sensations which are produced—in this case, visual ones—are appropriate to the particular nerve cells brought into action, rather than to the stimulus—in this case, the sudden mechanical pressure.

But though stimulation of different sensory nerves gives rise to different kinds of sensation, this is not because the impulses are somehow different. As we already have seen, nerve impulses differ only in amplitude and rate of propagation. The specificity seems to lie in the *kind of brain neurons* located in the part of the brain where a particular sensory track ends.

Here we come to one of the oldest problems of neurology and psychology: whether or not there is localization of function in the brain. For a long time a controversy raged between one group which held that each part of the cerebrum had a definite function which it alone could perform, and other groups which held that the parts were more or less interchangeable functionally. A compromise position now seems to be the most tenable one. But for particular motor and sensory functions, several special areas in the brain have been located.

The motor area. The cortex immediately in front of the fissure of Rolando has to do with motor functions. Long neurons lead down from this area through the spinal cord to the motor neurons, which supply the muscles of the body and the extremities. When a part of this area is stimulated, some voluntary-muscle group responds, and when areas in this region of the brain are destroyed, movement is impaired accordingly. The paralysis following a

"stroke" is due to interruption of these fibers at or close to their origins in the motor cortex through loss of blood supply.

The feet are represented at the upper part of the motor area of the brain, the trunk farther down, and the hands still farther down; the face and tongue are localized at the bottom. The body is thus represented upside down.

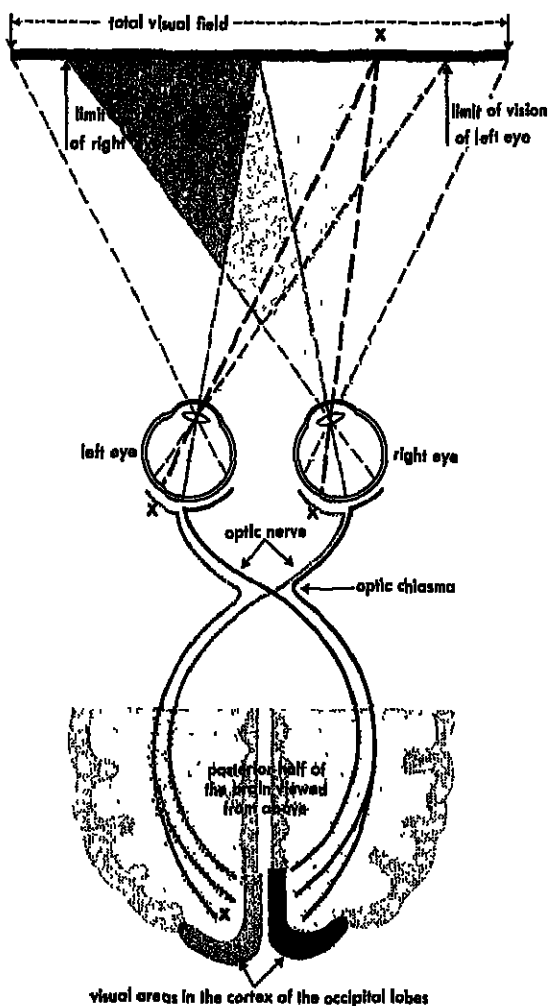
The somesthetic area. Just back of the fissure of Rolando is the *somesthetic*, or body-sensitivity, area. When this area is destroyed, the human individual suffers important losses of sensory ability. Such a person cannot tell where an object is touching him; he will be aware merely of an unlocalized pressure. He can still feel pain, and he can tell the difference between very hot and very cold objects, but he cannot distinguish between grades of warmth and cold. With his eyes closed, he cannot tell the position of his arms or legs or how they are being moved by the neurologist. When the skin is touched, he must look to see where the stimulus is, for he has lost the ability to localize the origin of sensations. He can handle objects, for he retains the power of movement, but he cannot tell you whether it is a key or a coin that he is handling unless he looks at it. He cannot tell sandpaper from silk, although he may report that one is pleasant and the other unpleasant.

If the somesthetic area on one side of the brain is destroyed, sensory ability is affected only on the other side of the body. If only a part of the somesthetic area is destroyed, the impairment is limited to a part of the body. In general, sensory and motor representation of the same part of the body lie just across the fissure of Rolando from each other. The body surface is "projected" onto the somesthetic area by neural connections as a lantern slide is projected onto a screen.

The vague, diffuse sensitivity that remains when the somesthetic area is destroyed is due to the action of the *thalamus*, a part of the old brain. In lower animals having a small cerebral cortex, this old part of the brain is responsible for nearly all sensation. In man, although most of the sensory function has been taken over by the cerebral cortex, pain and this diffuse, poorly localized sense of pleasure or discomfort are still controlled by the old brain.

The visual area. Just as the various parts of the skin of the body are projected upon the

The Mechanics of Seeing



In normal vision, light from one point in the right half of the visual field stimulates points on the left halves of both retinæ, instigates neural activity over two nerve pathways, and finally activates only one point in the left visual cortex, as shown above. Light from an adjacent point in the visual field will, in turn, activate a different but adjacent point in the visual cortex. Thus a single image of the world is built up despite the double pathways to the cortex. Meanwhile, the points in the left half of the visual world are activating points in the right half of the visual cortex. How the two halves are joined in our consciousness is still a mystery.

somesthetic area of the cortex by means of neural connections, so is the retina of the eye projected on the cortex of the occipital lobe. A huge bundle of nerve fibers constituting the optic nerve leads back from each retina, forming a cross at a point well back from the eyes themselves and located at the base of the brain. The fibers from the inner or nasal half of each retina cross and go to the opposite hemisphere, while the fibers from the outer or temple side of each retina go to the hemisphere on the same side. This means that the *left* halves of both retinas, which receive light rays from the *right* side of the world (because of the lens), send fibers to the left hemisphere of the brain. Thus in all three spheres—vision, touch, and motor control—the *right* side of the body and of the world involves mechanisms on the *left* side of the brain.

If one optic nerve is damaged, a person loses vision in one eye, but if one occipital cortex is damaged, the person loses vision of one half (the half on the opposite side) of the world. In this latter case, because only half of each retina is blind, the condition is called *hemianopia*, or "half-inability-to-see." When part of the optic tract or of the visual cortex on one side is destroyed, blindness results in the corresponding parts of the two retinas which is less extensive in area than blindness brought on by complete destruction of the optic tract or the visual cortex.

When a light falls on a particular point of the retina of a normal eye, electrical activity can be detected at a corresponding point on the occipital cortex. By moving the point of light and noting the change in position of electrical activity, the occipital cortex has been mapped, and a fairly close point-to-point correspondence between the visual area and the retina—and hence the external visual world—has been established. The retinal "picture" of the outside world is translated into a pattern of nerve activity on the cerebral cortex. This arrangement is believed to provide a basis for visual space perception and for seeing complex visual patterns.

Beyond the facts just presented, however, little is known of the brain mechanisms in seeing. How the brain represents depth and hue, for example, is still a mystery.

Clinical studies reveal an important difference between the organization and functions of the visual and somesthetic areas of the cortex. Destruction of the visual cortex in man is

followed by complete blindness. Similar destruction of the somesthetic area, as we have seen, merely destroys ability to differentiate finely between stimuli. Destruction of the visual cortex in monkeys, cats, and dogs, however, is not followed by complete blindness, as it is in man. In animals, vision of colors and patterns is almost entirely abolished when the cortical areas are destroyed, but light can still be distinguished from darkness by the use of subcortical centers.

These differences are explained by the fact that as we ascend the evolutionary scale, there is more and more *encephalization*—that is, an increasing tendency for the higher parts of the brain to take over the functions of the lower parts of the nervous system. As we pass from the lower to the higher animals, we find that the cortex assumes more and more importance. The encephalization of function is most noticeable in the case of vision; the somesthetic functions have undergone considerably less change (Marquis, 1936).

The auditory area. From the receptor cells for hearing, located in the inner ear, nerve fibers lead into the brain to relay stations through which responses to sounds are made possible. From connections in these relay stations, chains of neurons continue upward to the auditory area of the cortex, which is located in the wall of the fissure of Sylvius that belongs to the temporal lobe. Approximately as many fibers go from each ear to the cortical area on the same side of the brain as go to the cortical area on the opposite side. For this reason, destruction of the cortical auditory area on one side reduces hearing ability very slightly.

We now have some idea of the manner in which the brain functions in producing the conscious qualities of auditory sensation, especially pitch. Different nerve fibers in the auditory nerve and different areas within the auditory cortex respond to high, low, and intermediate pitches. Thus the doctrine of "specific nerve energies" seems to apply even within a single sense department.

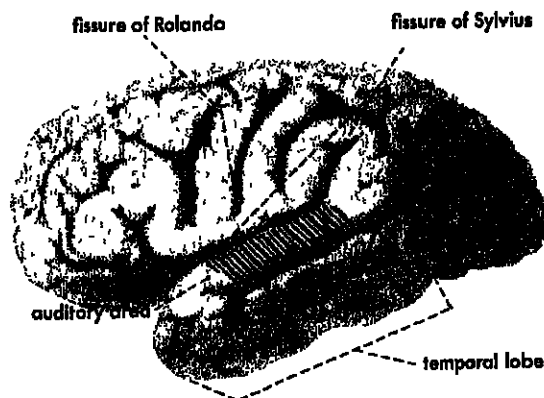
The gustatory and olfactory areas. Each year millions of dollars are spent to buy pleasant tasting food and pleasant smelling perfume, yet very little is known about the brain mechanism for the two chemical senses of smell and taste. Nerve fibers come from the olfactory patches of the nostrils to connect eventually with the oldest part of the cere-

bral cortex, known as the *hippocampus* and *hippocampal gyrus* and located directly beneath the temporal lobe. Fibers from the olfactory patches also lead to other parts of the old brain, where they set up connections making possible reflex movements to smell stimuli. The centers for taste are usually said to be in a region close to the olfactory area, but some research suggests that taste is a highly developed touch sensation and is localized near the somesthetic area for the tongue (Börnstein, 1940).

The association areas. If we make a drawing of the cerebral cortex and mark off the areas now known to be essential to motor and sensory functions, we find that by far the larger portion is not touched by our pencil. These parts are not unused, however. They are the *association areas*.

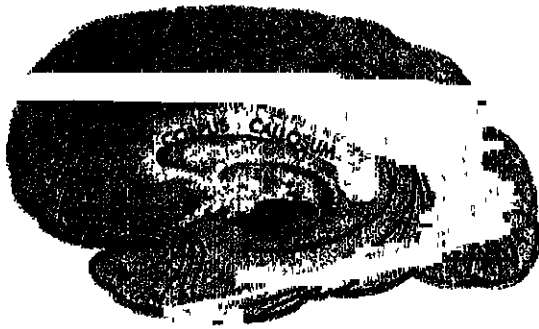
The association areas of each side of the cerebral cortex are connected with each other, with motor and sensory areas, with similar areas on the opposite side, and with the thalamus. They serve to correlate and integrate the simpler functions of the sensory and motor areas. In fact, the sensory areas are gateways into the cortex, and the motor area is the exit, the real work of the brain being done

The Auditory Area on the Temporal Lobe



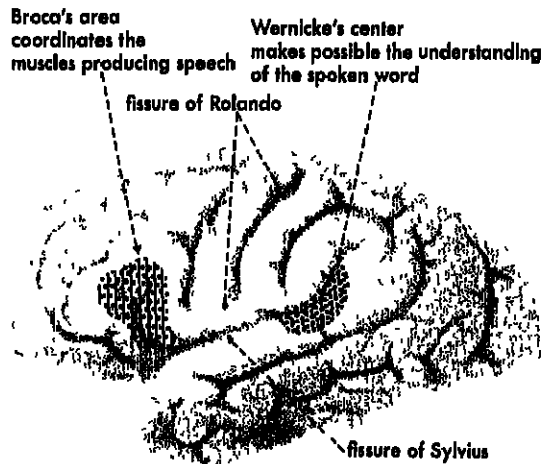
The shaded area above indicates the auditory area. Actually it cannot be seen when the temporal lobe is in normal position, because it is then out of sight in the fissure of Sylvius. The auditory area has specialized sections: the part nearest the frontal end registers low tones; the middle part, middle tones; and the part nearest the occipital and temporal lobes, high tones.

The Association Fibers of the Brain



The various specialized cortical areas are connected by numerous association fibers. Some of these are short, connecting adjacent areas; others are long, connecting such distant points as the forward part of the frontal lobe and the occipital lobe. Both long and short fibers connect the frontal and temporal lobes (B-B and C-C). Other association fibers, not shown, join the two hemispheres via the corpus callosum and coordinate their functioning.

The Areas of the Brain Concerned with Speech



Use of spoken and written language depends on enormously complicated neural patterns. Both Broca's area and Wernicke's center are concerned with the process of speech, but neither can be considered to perform an isolated function. Broca's area is probably related in function to the motor area of the cortex that controls the tongue and jaws. Wernicke's center is involved in the recognition and revisualization of auditory symbols and the comprehension of spoken and written words.

by the association areas. For example, injuries to the cortex outside but near the visual area, though not causing blindness, destroy awareness of depth and recognition of visual objects.

Attempts to localize the more complex mental processes were carried out at first by physiologists, without the help of psychologists. By the beginning of the twentieth century, however, the psychologists were engaging in active work in the field.

Much is now known of the relationship between damage to association areas and defects in speech and understanding of words, although there is still much to be learned before speculation is eliminated and discordant theories are reconciled. Study of the speech functions of the association areas began in the last century.

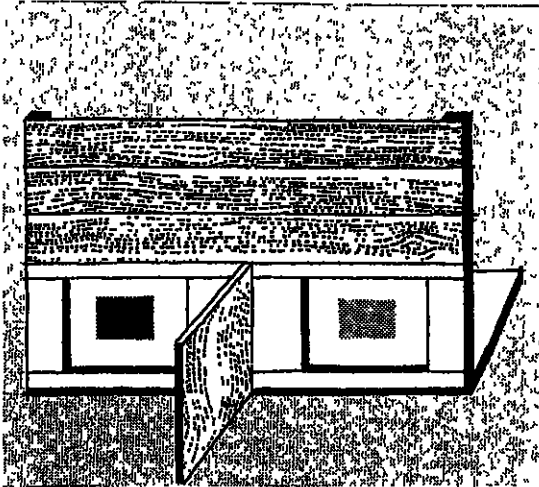
In 1861 Broca reported the classic case of a patient who showed an almost complete loss of speech ability. Careful examination of the patient's brain showed that an area in the frontal lobe of the left cerebral hemisphere just above the fissure of Sylvius and extending to it was destroyed. This area has come to be known as Broca's area; it is shown in the diagram at the left.

About ten years later Wernicke discovered that destruction of the cortex of the left temporal lobe below the auditory area, extending backward and curving up around the end of the fissure of Sylvius, was associated with inability to understand spoken language. This area, known as Wernicke's center, is also shown in the diagram at the left.

Subsequent investigations have upheld the validity of these early observations and have extended their significance by showing that similar phenomena occur when other association areas are destroyed. As you know, older people tend to lose their ability to learn new facts, to see new relationships, and to solve new problems. In extreme cases these behavioral losses have been found later to be correlated with degenerative changes in the cells of the cortical association areas.

These first observations on the association areas laid the foundation for many detailed researches from which numerous important conclusions have been drawn. In a general way the association centers have been found to be the parts essential to abstract learning and to the use of symbols to represent absent objects and events in thought and speech.

Visual-Discrimination Apparatus



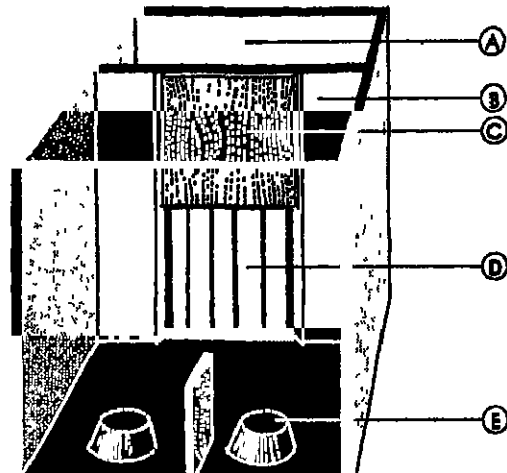
One approach to the problem of locating the higher centers utilized the extirpation method already described. Monkeys and other animals were trained to perform certain tasks, such as opening a puzzle box or running a maze. After the habit was well learned, portions of the brain would be surgically removed and the animals retested to see how much the habit had been impaired.

Such experiments showed that in the case of some (but not all) habits, the removal of certain parts of the cortex will abolish the habit, which can then be relearned. If the habits had been permanently abolished—i.e., if relearning had not taken place—we would have been forced to conclude that localization of such functions is hard and fast.

However, complete localization did not seem to exist, especially in the rat. Loss of cortical tissue did slow up the original learning of a maze habit by the rat, but the loss in learning ability seemed to be dependent upon the amount rather than the location of the cortical tissue removed. It is not hard to find a probable explanation for this. Ordinarily many sensory cues are available to guide the rat through the maze—more, indeed, than the rat needs. Removal of a part of the brain may destroy certain sensory elements but not others (Lashley, 1929).

The first work with rats has been followed by many other studies of great importance on other and higher animals. A dog from which the entire cerebrum has been removed—a very difficult operation—shows some signs of becoming conditioned to an auditory stimulus, but the behavior never becomes as specific and neat as in normal dogs. The response used was the lifting of the foot at the sounding of a

Delayed-Response Compartments



tone to avoid an electric shock on the paw. The dog, after many trials, showed a sluggish and generalized reaction to the tone, involving the whole body as well as the foot receiving the shock (Culler, n.d.).

Still another group of experimenters have studied the results, in monkeys, of destroying the most forward part of the frontal lobes, which is a purely association area. They made lesions of varying size and location within the frontal lobes and analyzed the results in two types of behavior situations: (1) situations in which the essential cues were present in the animal's environment at the time of the response (problem boxes, discrimination habits, etc.); and (2) situations in which certain essential cues had to be recalled from recent experience (delayed responses).

In the first series of experiments, involving problem boxes and discrimination tests, sensory cues were always present, and symbols were not necessarily involved. In the problem boxes the food was obtained by solving a simple puzzle—such as turning a crank through an arc of 270 degrees in a clockwise direction, pulling a rope projecting from the box, opening a latch, or performing in proper sequence five such movements to release the lid of the box containing food. In the visual-discrimination experiments, the food was found behind a stimulus card which differed in brightness from another stimulus card behind which there was no food. The correct card was placed to the left or to the right in random order so that the animal had to react to the brightness to make the correct choice. The monkeys eventually chose the proper card without false moves.

In the second type of experiment—the delayed-response experiment—the monkey was placed in

compartment A with door C raised so that response chamber B was visible through the grill D. The monkey's attention was attracted by the experimenter, who placed a piece of food under one of the inverted cups shown at section E. The door C was then lowered for a time, after which the door and the grill were raised so that the animal could walk into the forward compartment and get the hidden bit of food. The object was to see how long the animal could delay with the food out of sight and still go directly to the correct cup, which was changed from side to side in random order. The important psychological feature of this situation is that the animal had to react partly on the basis of memory. Obviously the position of the food had to be represented by some symbol during the period of delay and that symbol had to function as a stimulus in guiding the final response after the delay had terminated.

The experimenters' results are summarized below:
"1. Unilateral lesions (lesions on only one side of the cerebral cortex) caused no impairment of performance on any tests . . .

"2. Bilateral lesions (lesions on both sides) of the frontal association areas, either partial or complete, resulted in different effects in the two situations:

"(a) Memory for simple problem-box habits and for visual-discrimination habits was not impaired, nor was ability to learn new tasks of a similar nature reduced.

"(b) The ability to perform a delayed response was abolished by complete lesions of the frontal areas. The subjects failed in this test with delays as short as one or two seconds" (Jacobsen, Elder, and Haslerud, 1936).

These results confirm for the monkeys the same sort of thing observed in the case of human speech difficulties due to lesions in the speech centers. The association areas are essential to the performance of behavior which involves the use of symbols.

The method of extirpation, as we have seen, is normally possible only with animals. In man, localization of function must be deduced in other ways.

Disease or injury to certain association areas will bring about an interesting condition in which the person is unable to recognize objects by their "feel." Some familiar thing such as a door key or a pencil can be handled indefinitely and still not be recognized. Patients who show this type of disorder are still capable of experiencing normal elementary sensations. Their difficulty is in grouping these elements

into normal perceptions: Objects are felt but not known.

Similar disorders of perception are found in other sensory fields. These disorders are called *agnosias*, or "inabilities to know," and are classified on the basis of the nature of the function which is impaired. Related disorders affecting language are called *aphasias*. The following list defines the more frequently encountered agnosias and aphasias:

ASTEROGNOSIS Loss of ability to recognize solid objects through the sense of touch (cutaneous and kinesthetic senses).

ALEXIA Inability to recognize printed words. This is commonly called "word blindness."

SENSORY APHASIA Inability to recognize spoken words. This condition is sometimes called "word-deafness," and it can occur in persons who can hear simple sounds.

These particular conditions seem to be associated with lesions in the association regions close to sensory areas of the cortex.

Similar impairments of the association region near the motor areas will give rise to motor disturbances, especially of the apparatus used in speech. Some of the more common of these are:

APRAXIA Defective ability to perform common manipulation (for example, lighting a cigarette) in the absence of real paralysis.

AGRAPHIA and PARAGRAPHIA. Loss of the ability to write or the employing of the wrong word or some meaningless symbol.

MOTOR APHASIA Loss of ability to use spoken language although the larynx is not paralyzed. The use of the wrong spoken word is called **PARAPHASIA**. For example, an elderly lady says in quite a matter-of-fact tone: "I staved the stafflings gage."

In some cases the sensory and motor aspects of speech are little affected, yet there are subtle disturbances of speech which are difficult to describe. Aphasia at this level merges into intellectual functions, just as it merges into sensory loss and motor paralysis at the other end of the scale.

Early neurologists ascribed quite specific disturbances to specific cortical areas. Such cases are rare, but so are cortical lesions confined to restricted regions. Physiologists now agree that lesions in front of the motor areas have most effect on motor speech functions, and that those in the parietal and temporal regions have most effect on sensory functions. Intellectual speech defects, indicative of faulty intellectual processes, are often caused by mild but widespread damage to the cerebral cortex, rather than by specific lesions of the "prefrontal area" as was once believed.

All this evidence from laboratory and clinic indicates that the association areas do control and integrate speech and other complex activities involving the use of symbols.

THE PROBLEM OF CEREBRAL DOMINANCE AND HANDEDNESS

As you have already seen, there is almost complete crossing over of the sensory and motor fibers from one side of the body to the *opposite* side of the brain. The left side of the brain "sees" the right half of the world, feels with the right half of the body, and controls the muscles of the right half of the body. There is much evidence, however, to suggest that in certain functions one side of the cerebrum controls both sides of the body and is therefore said to be *dominant*. In normal right-handed persons, the *midline functions* (those carried out by structures such as the larynx) are apparently controlled by the left side of the brain.

Whether dominance comes about through heredity or through use is not altogether clear, but there is evidence to suggest that cerebral dominance is at least in part a matter of use. Regardless of how it arises, any disturbance of it seems to be a condition of great significance, as some interesting clinical cases show:

On October 14, 1931, a right-handed woman came to the New Haven Hospital. She was unable to write her name completely, showed a pronounced defect of memory, and was totally blind to objects appearing on her right side. She had difficulty in reading printed matter held in the unimpaired field of vision and in recognizing pictures of familiar objects and scenes.

These symptoms suggested that something was amiss in the *left* half of her brain. A surgical operation was accordingly performed, and a large tumor was found on the left side (of the brain) at the very back of her brain in the posterior aspect of the occipital lobe (German *et al.*, 1932).

Another significant case for our discussion is that of a *left-handed* young man who had his left frontal lobe, including Broca's area, removed because of a tumor but *failed* to develop aphasia or speech disorder (Association for Research in Nervous and Mental Disease, 1932). Had he been *right-handed*, he almost certainly would have become aphasic because the motor-speech centers of the *right-handed*

person are in the *left* frontal lobe. Apparently left-handedness goes with the dominance of the motor-speech centers in the right frontal lobe.

Another case of a patient suffering from aphasia has a bearing on this discussion. The patient was naturally right-handed and learned to write with the right hand. At the age of ten the right hand was amputated, and the patient relearned writing with the left. Several years later an injury to the right hemisphere produced motor and sensory aphasia. After surgical removal of a cyst, marked improvement in the symptoms of aphasia was noted (Lovell, Waggoner, and Kahn, 1932). Apparently cerebral dominance had become established in the right hemisphere, suggesting that cerebral dominance is produced to a certain extent at least by usage, since in this case the individual had originally been right-handed.

Innumerable cases have been reported in which attempts to train the left-handed child to use his right hand have been followed by disorders of speech (Travis, 1931). The interpretation is that changing the *naturally left-handed* child disturbs the dominance of the *right* cerebral cortex, which is normal for him. In the transition stage from left to right-handedness we would expect a period of rivalry if cerebral dominance is a matter of relative amount of use. This period of conflict or uncertain dominance would cause conflicting impulses from the two hemispheres to reach the speech organs at the same instant. The result would be the spasms and deadlocks which are typical of the stutterer. Moreover, a significant number of such cases have been improved or cured following a deliberate switching back to the left hand. In corresponding manner, there is evidence that forcing a right-handed person to use the left hand will produce stuttering. If cerebral dominance is at all determined by the native constitution of the individual we could well expect that attempts to switch to the "unnatural" hand would lead to permanent conflict between the two cerebral hemispheres with consequent persistence of the stuttering. This whole matter is still somewhat unsettled, for the facts are not entirely consistent.

Certainly stuttering can be caused by conditions other than switching from one hand to the other. Emotional conflict, for instance, is one important source of stuttering. It is possible that at least part of the effect of switching grows out of the emotional upset engendered by the nagging of the child by parents and teachers who are trying to "correct" his left-handedness.

BRAIN WAVES AND THOUGHT

You have already learned that both nervous tissue and muscle tissue, when active, have the characteristic of generating minute electric currents that can be measured and analyzed. It has been found that such currents in the brain (brain waves) are highly consistent for a given individual and quite similar in identical twins. They differ somewhat for different regions of the cerebral cortex. It is significant that the brain never rests, even in the absence of special sensory stimuli. In fact, visual stimuli demanding attention stop rather than start the rhythms of the occipital lobe.

Sleep and anesthesia produce large, long waves, whereas alertness or excitement is accompanied by small, rapidly repeated waves. Many attempts have been made to correlate specific types of brain waves with particular types of situations. (See pages 558-562.)

One psychologist recorded the waves from the scalp over the visual area of 132 children ranging in age from a few weeks to sixteen years (Lindsley, 1951). He found that a certain pattern of electrical discharge is established at about three months of age, and, once established, it is never lost. Its frequency increases rapidly during the first year, then more slowly until the adult level is reached at about twelve years of age. Amplitude increases during the first two years, dropping sharply during the third year and more slowly thereafter, to reach the adult level at about fifteen years of age. The time at which the brain waves are first observed in infants corresponds closely with the appearance of the first evidences of visual perception. This coincidence in time suggests a functional relationship.

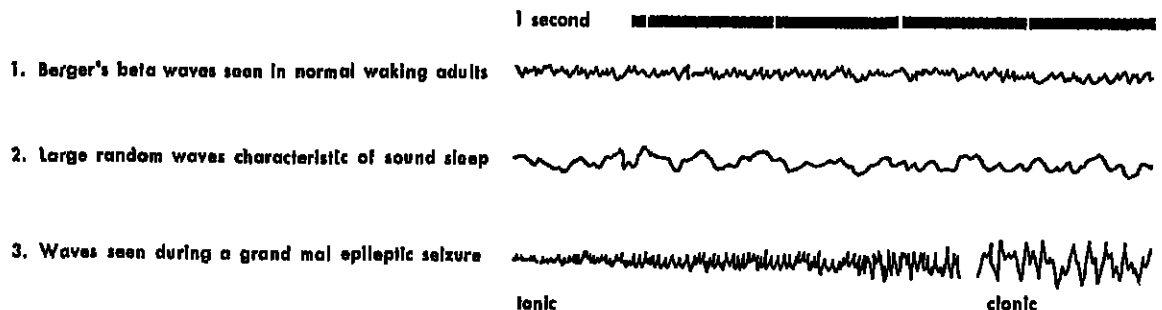
In another study the technique of brain-current registration was applied to the problem of stuttering. Records of normal and stuttering subjects were taken during silence and during simple propositional speech. The electrodes were inserted in the scalp over the visual cortex of the brain. The normal subjects gave waves of a duration of one-tenth second while silent. During speaking, the waves of the normal subjects were faster, each one lasting .09 seconds. The comparisons between the stutterers and the normal subjects showed such small differences that no definite conclusions can yet be drawn from them (Travis and Knott, 1936).

In still another experiment subjects were asked to sit in an apparatus for measuring brain waves and were given instructions to relax and "let their minds wander." Without warning the experimenter would say "Now" and ask the subject what state of consciousness had been interrupted. By comparing the pattern of brain waves with the nature of the conscious state accompanying them, it was found that abstract thought and blankness went with large waves and that concrete experience, such as sensation and vivid imagery, was accompanied by small waves (Travis, 1937).

It has also been found that epileptic seizures are accompanied by characteristic brain-wave patterns. Between attacks, abnormal waves occur which can be used in diagnosing epilepsy (Gibbs, Gibbs, and Lennox, 1937).

Studies of this sort are promising, but it should be noted that they are concerned with quite a different sort of problem from any attempt to hook up the apparatus to the scalp of the subject and read the complete story of his thinking—that is, "read his mind."

Three Types of Cerebral Electrical Potentials



THE NERVOUS SYSTEM IN EMOTION

One of the long-accepted facts about the nervous system has been the distinction between the autonomic and voluntary nervous systems. It has long been known that speech, postural responses, movements of arms and legs, and other "voluntary" activities are integrated through the somatic components of the cranial and spinal nerves, while emotional behavior involves activity of the visceral or autonomic division of the nervous system.

In recent years, however, physiologists have come to realize that this division is not a hard and fast one. For instance, many reflexes are voluntary-muscle responses which take place in the absence of conscious willing. Moreover, *certain autonomic responses can be brought under voluntary control*, as has been shown in an important experiment:

The natural, or inborn, response to a loud auditory stimulus includes the dilation of the pupil of the eye. A strong beam of light flashed into the eye leads, as we have seen elsewhere, to the constriction of the pupil. *Both of these responses are involuntary.*

In this study it was found that if a bell is sounded at the moment a beam of light is flashed in the eye of the human subject, the subject will after many repetitions respond to the sound of the bell alone by a constriction of the pupil. This is a conditioned response involving smooth muscles and is much harder to establish than conditioned responses involving striped, or voluntary, muscles.

By a clever experimental procedure it was discovered that the constriction of the pupil could also be conditioned to the following kinds of stimuli: (1) a nonsense syllable spoken by the experimenter; (2) the experimenter's command, "relax"; (3) the gripping of an object by the subject; (4) the subject's saying aloud "contract," "relax"; (5) the subject's whispering these words; and (6) the subject's *thinking* these words (repeating them in subvocal speech).

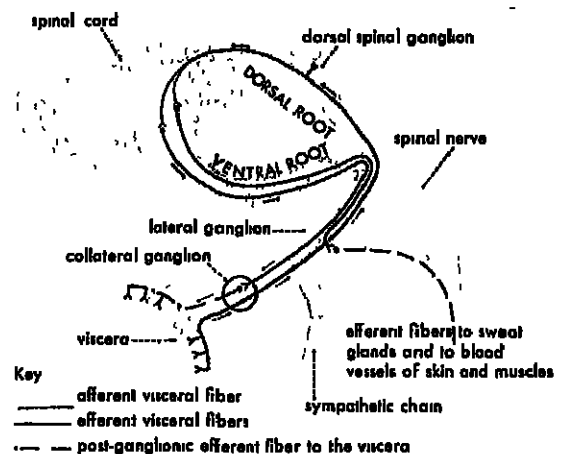
When the bell was sounded without the light, the well-conditioned subject would eventually lose his conditioning. This is the customary *experimental extinction* expected when the secondary stimulus is presented frequently with the reward or punishment removed. However, the conditioned response to the verbal stimuli would *not* undergo experimental extinction (Hudgins, 1933).

But although the distinction between the autonomic and voluntary nervous systems is not so hard and fast as formerly thought, it is still a useful one for us to make.

THE AUTONOMIC OR VISCERAL NERVOUS SYSTEM

The autonomic or visceral nervous system sends fibers to the visceral organs of the chest and abdomen and to other structures containing smooth muscles or glandular tissue. The term "autonomic" is a misleading one, since this part of the nervous system is neither autonomous (self-regulating) nor automatic. It is made up of a set of reflex arcs which are subject to the control of certain centers in the brain just as are the somatic parts of the nervous system, but with the important difference that in the case of the visceral nervous system

Arrangement of Neurons in Spinal Cord and Ganglia



This is a diagrammatic cross section of the spinal cord and the spinal roots and nerves. Sample neurons show the pathways of the spinal roots and nerves and the locations of the synapses. The spinal nerve carries impulses to and from the skin, muscles, and bones; the visceral nerves carry impulses to and from the viscera. All sensory fibers enter the spinal cord in the posterior root and have their cell body in its ganglion. Motor nerve fibers go out of the spinal cord in the ventral (forward) root; those going to the viscera have a synapse in an outlying ganglion.

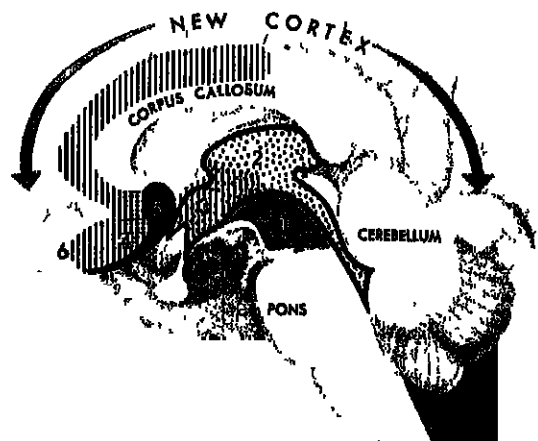
these higher centers are largely in the old brain rather than in the cerebral cortex. Thus very little voluntary control of visceral functions is possible without special training. Control of the skeletal muscles can, of course, be either reflex or voluntary.

The autonomic nervous system also differs from the somatic components of the nervous system in having synapses outside the central nervous system. The synapses of the somatic components are located entirely in the brain and spinal cord.

Physiologists have discovered that it is necessary to distinguish between two parts of the autonomic nervous system—the *sympathetic* and *parasympathetic* divisions. (See page 481.)

The sympathetic division. Branching off from certain of the spinal nerves are small bundles of fibers which run to a chain of *ganglia* (nerve centers) lying on either side of the spinal cord. The fibers run up or down in this chain and then synapse with effector neurons that run to smooth muscles and glands of the skin, via nerves which rejoin the spinal nerves. At certain points nerves leave this chain and pass to more distant ganglia where their fibers synapse with others that run to the visceral organs. Since these fibers come from only a dozen or so of the spinal segments in the middle of the back (thoraco-lumbar) but ultimately reach structures from the head to the toes, it is clear that the sympathetic chain is a distributing mechanism. They are clearly correlation neurons. This part of the autonomic system is called the *sympathetic* nervous division, because the older anatomists believed that its function was to make the visceral organs work in "sympathy."

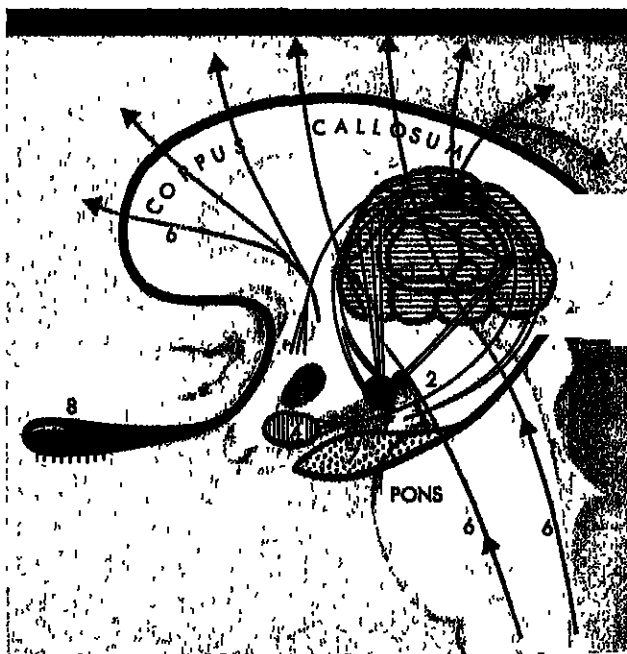
The parasympathetic division. From the lower segments of the spinal cord and from the brain stem originate certain nerves which look like ordinary cranial and spinal nerves. But when traced, they, like the sympathetic nerves, are found to pass to visceral structures and not to the skeletal muscles. And, like the sympathetic nerves, they are interrupted by a synapse outside the central nervous system. For these reasons such nerves must be counted a part of the autonomic nervous system. Since they branch off from the central nervous system above and below the sympathetic nerve fibers, they are known as the parasympathetic or cranio-sacral division of the autonomic system.



- | | |
|-----------------|------------------------|
| 1. mid-brain | 4. septal area |
| 2. diencephalon | 5. transitional cortex |
| 3. hypothalamus | 6. olfactory cortex |

Centers of Emotion in the Brain

These diagrams show the approximate locations and relationships of the structures discussed in the next few pages. Complete accuracy would require three dimensions. The close-up below details in black the rhinencephalon, which encircles the corpus callosum and has centers in both frontal and temporal lobes.



- | | |
|--|--|
| 1. thalamus | 5. septal area |
| 2. subthalamus | 6. ascending reticular system (blue lines) |
| 3. ventro-medial nucleus of the hypothalamus | 7. hippocampus |
| 4. amygdala | 8. olfactory bulb |

Most organs of the chest and abdomen receive fibers from both divisions, and where this happens, the action of the two divisions is always antagonistic: one excites the organ to increased activity, the other inhibits or decreases its activity. Thus the autonomic nervous system could be likened to the accelerator and the brake of an automobile and makes for a very effective control of the visceral organs. It must be pointed out, however, that one system is not the accelerator of *all* organs and the other the brake of *all* organs. Whether the parasympathetic inhibits or activates a particular organ depends on what that organ does.

Division of labor in the autonomic system. Most of the ordinary vital functions of life are governed by the parasympathetic division. To allow this, the sympathetic takes a back seat; in fact, the whole sympathetic division has been removed from animals without greatly disturbing the ordinary processes of life. The parasympathetic division protects the eye from bright light by constricting the pupil; and it adjusts the lens of the eye for near vision. The passage of food along the alimentary canal, its digestion, and finally the elimination of waste products are all actions depending on the parasympathetic division. During sexual excitement, the sexual organs become suffused with a richer supply of blood by the action of this division. During the orgasm the sympathetic division is active, proving that the two divisions can work together in sequence.

If the parasympathetic is the drudge that carries on the everyday tasks of life and meets the minor exigencies, the sympathetic division is the trouble-shooter which steps in and takes charge in the case of a real emergency. It operates when the life of the organism is threatened, and it calls upon all the reserves of energy which parasympathetic activity has built up and held in abeyance for just such emergencies. The sympathetic is known to take over under three conditions: (1) when life is threatened by extreme cold, (2) during violent effort or exercise, and (3) during states of fear and rage.

The action of the sympathetic division in strong anger is of special interest to the student of psychology. (See page 151.) It includes dilating the pupil of the eye, lifting the lid overwide and protruding the eyeball, speeding up the heartbeat, raising the blood pressure, and taking from the sex organs their

supply of blood, with the result that they tend to become flabby. In extreme anger it enables the liver to pour out sugar to be used by the muscles, the spleen to pour out more blood cells to carry oxygen, and the bronchioles to dilate so that more air reaches the lungs. There is a cessation of the digestive movements of the stomach, the peristaltic contractions of the stomach, and the secretion of the digestive juices. In short, the digestive organs "close up shop" in extreme anger, due to inhibition by the sympathetic division. The blood is then diverted to the muscles, for in an emergency it is more important to be able to run from danger than to digest food. In hairy animals the hair stands on end; this is seen as a vestigial response in our bodies in the form of "goose flesh." Finally, the adrenal glands are spurred to great activity and the adrenaline secreted into the bloodstream duplicates the actions of the sympathetic division and hence reinforces all of the above processes.

It is now widely recognized that the bodily manifestations of emotion can cause functional disturbances, pain and discomfort, and even organic pathology. In some instances parasympathetic overactivity is responsible (stomach ulcers); in others, sympathetic activity (cold and sweaty hands); in some others, overactivity of the somatic system is responsible (many backaches and headaches). *Psychosomatic medicine* is concerned with recognition and treatment of such cases and is an important common ground between psychology and medicine.

Visceral sensation. In the same nerves with the motor fibers to the viscera are numerous sensory fibers coming from the visceral organs. Those found in the sympathetic nerves are concerned with conducting pain impulses; those found in parasympathetic nerves are not usually concerned with pain but conduct impulses giving rise to organic sensations such as hunger, nausea, and sensations from the bladder and colon. The latter are necessary for the reflex control of the viscera in such functions as vomiting and micturition (urination). The modern surgeon takes advantage of this double pathway of sensation from the viscera by severing appropriate sympathetic nerves and thus relieving his patients of excruciating pain from diseased visceral organs without affecting the messages that travel over parasympathetic fibers.

Ordinarily we are quite unaware of any movement going on in our viscera. The pupils of our eyes will dilate in pain. We feel the pain but are unaware of the fact that the pupils have become larger unless we see them in the mirror. In other instances, when we think we are aware of our viscera, as in thinking we feel the heartbeat, we are really receiving the sensation from the chest wall, not over the sympathetic nerves from the heart. It is observed by surgeons that if the abdominal cavity is opened under local anesthesia, the viscera can be cut, pinched, or even burned without arousing pain. Yet we know that severe, unbearable pain can arise in the viscera in the form of cramps, stomach aches, and so on, and we are all familiar with strong sensations of hunger and nausea. The explanation is that because of the protected position of the viscera, there has been no occasion for sensitivity to cutting and burning to develop, whereas distentions and contractions have become adequate stimuli.

It may be wondered why, if contraction is adequate stimulus, we are unaware of the normal peristalsis of the intestines. This is a matter of *threshold*. When the contractions are normal, as in the ordinary processes of digestion and excretion, they do not reach sufficient intensity to stimulate the sensory fibers; hence no sensation reaches consciousness. However, if they are strong, spasmlike contractions, as in diseased states, we may become very conscious of our viscera. Visceral sensations are really danger signals and compel us to some action to correct what is wrong. The connection between visceral sensations and drives is thus apparent.

Visceral sensations differ from those arising from the skin in that they are diffuse and poorly localized despite their intensity. In fact, they are often wrongly localized and seem to come not from the viscera but from the skin. Thus, when severe pain originates in a diseased heart, it seems to come from the chest wall or sometimes even from the back of the arm.

CENTERS OF EMOTION IN THE BRAIN

The autonomic nervous system is only the peripheral part of the neural mechanism for emotion. Higher centers in the brain receive messages from it and deliver messages both

to it and to the somatic nerves to give the patterns of emotional display.

How does the cortex function in emotion? Evidence now suggests that there are three ways in which the cerebral cortex plays a part in emotional responses.

1. Whether a situation arouses emotion or not often depends on learning from past experience, which, in turn, usually requires the participation of the cerebral cortex. Thus the cortex is evidently involved in *evaluating* and *appreciating* the stimulus situations which give rise to emotion. The sense of appropriateness and refined emotional states like appreciation of a symphony or a painting are evidently dependent in part at least on the cerebral cortex.

2. The cerebral cortex has some power to *execute* emotional responses by arousing visceral activity (Fulton, 1939). Stimulation of the *transitional cortex*—a band of cortex running from the midline side of the frontal lobe across its underside and onto the temporal lobe—produces visceral responses and vocalizations which are interpreted as emotional responses. It seems likely that these areas are directly responsible for some of the higher types of emotional response, and the adjoining association centers, especially the frontal lobes, are undoubtedly important in adjusting the emotional response to the situation, since learned emotional responses involve symbols.

3. The cortex also serves as a check on unrestrained response. Normally, the intensity of emotional response tends to be proportional to the seriousness of the situation. But when certain parts of the cortex are destroyed or affected by alcohol, the individual makes wrong emotional responses or excessive ones. Likewise, a dog or cat without its cerebral cortex shows no gradations in intensity of emotion, exhibiting only the most primitive emotional behavior responses of pain, rage, and fear, plus certain basic sexual responses.

A cat in which the cerebrum had been surgically removed showed intense emotional responses to stimuli which were ignored by normal cats and by the same cat before the operation. A playful pat on the side would cause the cat to whirl with claws bared—so-called "sham rage" (Bard, 1934).

The forward part of frontal lobes, called the *prefrontal lobes*, are particularly concerned with the inhibition of certain kinds of emo-

tion and the expression of others. Damage to them changes the personality of the patient—the kind and strength of his drives and emotions and their appropriateness to the situation. As we saw in Chapter 8, some mental patients have been helped by prefrontal lobotomies, in which the fibers connecting the prefrontal lobes with the subcortical emotional centers were severed.

The cerebral cortex is certainly involved in both the maturation and the learning that change the infant's "all-or-nothing" emotions to the gradations, flexibility, and subtle nuances of adult emotional reactions. The unrestrained outbursts of the child are not unlike the "sham rage" of the decorticate animal: in both cases cortical control is lacking. But the details of the part that the cerebral cortex plays in emotional development are still largely unknown.

How do the subcortical centers function in emotion? The exaggeration of emotion rather than its disappearance after removal of the cerebral cortex proves that subcortical structures can organize certain emotional responses. These structures have been identified as lying in the *rhinencephalon* and the *diencephalon*—the region between the cerebral cortex and the mid-brain. Cutting away the brain down to the mid-brain ends all display of emotion.

The important structures in the diencephalon are the *thalamus*, which receives impulses from the whole body, including the viscera; the *subthalamus*, just beneath it, which exerts control over the voluntary muscles of emotional expression; and the *hypothalamus*, an important center controlling both the sympathetic and the parasympathetic systems. The *rhinencephalon* is the "nose brain," the oldest part of the cerebral hemispheres; it contains both primitive cortex and complicated subcortical structures.

Numerous clinical observations have shown that disease or tumor of this important region changes the whole emotional life of the patient. A lesion in one spot may bring about a condition of emotional apathy, somnolence, or even narcolepsy. After lesions in others, the patients may burst into uncontrollable laughter or tears although *feeling* no emotion or even a contrary one. Other patients experience emotion but give little or no outward sign, their masklike faces concealing their true feelings. Still others experience exag-

gerated pain and emotion, although the visceral responses are not increased.

It seems safe to conclude that outward and inward *behavior* and the *experience* of emotion are not one and the same thing (Harlow and Stagner, 1933). This raises two questions: What parts of these subcortical areas carry out *expression* of emotion (somatic, muscular, visceral, and glandular responses), and which ones play a part in the *experience*, or inward aspect, of emotion?

Expression of emotion. It is pretty certain from experiments in which parts of the diencephalon have been cut away that the subthalamus and the hypothalamus execute primitive emotions of rage, fear, and sex. Corroborating evidence is found when electrical currents are passed through this region. Stimulating certain parts of the hypothalamus throws the animal into a terrifying rage behavior or a fearlike behavior.

Just in front of the fear-rage executing center is the *ventromedial nucleus* of the hypothalamus. Tame rats that have been deprived of this area become savage and will bite a metal rod repeatedly; in one case a rat bit the hand of the unsuspecting experimenter who had happened to destroy the area by accident (Wheatley, 1944).

Further forward, beyond the hypothalamus, is another region of the brain concerned with rage or savageness. This is the *septal region*, along the dividing line between the two hemispheres, just below the front bend of the corpus callosum (page 500). Destructions here cause rats to overreact emotionally to handling or to a startling sound, to urinate or defecate, or to attack an object placed near them—a mixture of fear and rage responses (Brady and Nauta, 1953).

The septal region is a part of the *rhinencephalon*, which also has been found to contain other centers for rage and sexual behavior (page 500).

Twenty years ago it was discovered that when the temporal lobes of monkeys, including a part of the *rhinencephalon*, were removed, the monkeys showed bizarre "oral tendencies," exploring every object by sniffing it and touching it with the lips. They also showed increased sexual activity (Klüver and Bucy, 1939).

More recently, the area responsible for such behavior has been identified as the amygdala. Lesions

at this spot caused monkeys and cats to become so highly sexed that a male monkey or cat, a mouse, or even a hen became a sexual object.

The same region is evidently concerned with rage and savageness. After destruction of the amygdala, wild animals cease to bite and scratch when handled or even pinched. A wild lynx, after amygdectomy, became like a tame tabby cat and could be handled and "pushed around" with impunity (Schreiner and Kling, 1953).

The behavior that follows *removal* of these areas is the reverse of the behavior they promote in the intact animal. Thus the amygdala acts as an accelerator of rage emotion, whereas the neocerebral cortex, the septal region, and the ventromedial nucleus function as brakes. If you remove the accelerator, the animal becomes tame and quiet; if you remove the brakes, the animal runs wild.

The exact interconnections of all these areas are not yet worked out. It may be that they are linked together as in a chain: septal region → ventromedial nucleus → posterior hypothalamus. Or it may be that they act directly on the nerve fibers that produce the visceral and skeletal muscle signs of emotion. Continuing research will undoubtedly tell us more about them.

Eating behavior and drinking behavior also have centers in this region and have been analyzed in the same way as rage and fear. Destruction of the ventromedial nucleus, which cuts loose the rage response, also takes the brakes off the animal's eating mechanism. In this condition rats or monkeys eat voraciously and become grossly fat. If not restrained, they may actually kill themselves by overstuffing. Stimulation of the ventromedial nucleus will stop the eating behavior even in a rat that is starving.

Just to the side of the ventromedial nucleus is a "feeding center." A lesion here stops a rat from eating, and though he remains able to chew and swallow, he starves to death. Close by, in the hypothalamus, is a comparable "drinking center." Stimulation of these centers causes an animal to eat or drink even when he is not hungry or thirsty and to continue to do so until he is grossly distended. In one experiment a goat drank water equal to 40 per cent of his body weight in a short time (Andersson and McCann, 1955). These animals are truly "push button" animals.

Experience of emotion. Does the animal

who shows rage or eating behavior during stimulation of the hypothalamus "feel angry" or "feel hungry" as the case may be, or is the eating purely mechanical, with no motivating experience of hunger? To answer this question, the physiologist must turn to the methods of the psychologist, since obviously the animal cannot introspect and report his experience. Whether the "push button" animals are truly motivated or merely eating mechanically whatever is at hand has been answered by recent experiments.

A male rat showing interest in a sexually excited female rat was stimulated electrically in his eating center. The ungallant rat immediately went off in search of food and started eating. When the current was stopped, he returned at once to the patiently waiting female. In this case it was clear that the animal was motivated—experienced motivation to behave as he did. Blocks of wood the size of food pellets were rejected, indicating that the eating was not purely mechanical (Maire, n.d.).

Conditioning experiments have provided us with further important clues as to whether these animals "feel" anger or hunger when they are acting angry or hungry. For example, a cat is trained to turn off a switch whenever it receives a shock to its feet (avoidance conditioning), and the shock is then suddenly transferred to the rage-fear center of the hypothalamus. Immediately, the cat shuts off the current. A cat can also be trained to avoid a dish of food by stimulation of the fear-rage center (Delgado, Roberts, and Millor, 1954). If we can assume that the cat finds the shock to the foot unpleasant, we can make the same assumption about the hypothalamic shock.

From such experiments we conclude that the hypothalamus does more than execute emotion by sending impulses to the muscles and glands. Evidently it also plays a part in the experience of emotion or sends impulses to some other area which does.

Further insight into emotion and motivation comes from other experiments in which an electric current has been applied to another deep structure, and the rat has repeatedly *turned on* the stimulus.

Rats with electrodes implanted in the brain were put in a box containing a bar which acted as a switch, causing a current to flow through the brain when pressed by the rat. Each time the bar was

pressed, another stimulus was given. Without any previous association of bar-pressing with reward such as food or water, the rats not only learned to press the bar but would press it incessantly, doing so as many as a thousand times an hour.

If the circuit were broken, so that pressing the bar gave no stimulus, the bar-pressing stopped. Then, if the circuit were reestablished, the rat returned to the bar and became a "bar fly" again (Olds and Milner, 1954).

In this case the electric current acted as a reward or reinforcement, like food or water, and the animal actively sought it. Does this mean that the rat experiences a pleasant feeling? If so, it is further evidence that the hypothalamus plays a part in both the experience and the expression of emotion.

It is significant that the brain areas that yielded the highest bar-pressing scores include some of the structures we have already encountered—the septal region, the ventromedial nucleus, and the amygdala of the rhinencephalon (Olds, 1956). (Remember that stimulation should produce the opposite effect from a lesion.) The new cortex and most of the thalamus leading to it gave consistently low scores.

A clue to mental disorder? In some emotional states you feel alert and excited, but when you are depressed, your brain seems slow and dull. Some insight into the reasons for this comes from studies of brain waves. As we have seen, brain waves during sleep are

quite different from those during emotional excitement. It has been found that stimulation of the hypothalamus and adjacent thalamus, which are responsible for excited emotional states, produces low-amplitude, quick, "spikey" brain waves like those found in anxiety or excitement in man (Magoun, 1952). Destruction of this general area produces large, slow brain waves like those of a sleeping person (Lindsley *et al.*, 1950). For further discussion of this system, see pages 559-560.

Note that these brain waves are in the *cortical* areas whereas the stimulation was in *subcortical* structures. This is made possible by a system of ascending fibers, the *ascending reticular system*, over which impulses go from the thalamus and the hypothalamus to "stir up" the cortex. Overactivity of this ascending system could cause mania, flight of ideas, and mental overactivity by driving the cortex too hard. By the same token, underactivity of the ascending reticular system could result in the symptoms we see in catatonia (page 201) or sleeping sickness.

The discovery of this ascending system running through the older parts of the brain is a major advance. The possible implications of this discovery for understanding mental disorder are incalculable. Altogether, the recent startling discoveries of the psychologists and neurophysiologists are like breaking through the sound barrier in aviation, opening the door on a whole exciting new field of research.

SECTION TWO

CAREERS IN



CAREER FIELDS

REGULATION
OF PSYCHOLOGISTS

FINANCIAL AID
FOR GRADUATE STUDY

The general public tends to think of psychologists either as therapists or as teachers. This was brought out in an informal survey of hotel waiters and other employees where a convention of the American Psychological Association was being held. About a third of them knew the convention guests were psychologists; another fourth thought they were psychiatrists. When asked about the actual work of those attending the convention, 71 per cent mentioned *psychotherapy* and 24 per cent regarded them as teachers, leaving only 6 per cent with any other ideas (Cohen and Wiebe, 1955).

CAREER FIELDS

Perhaps the newness of psychology as a profession accounts for the relative ignorance of the public concerning it. As compared to medicine and law, which were already flourishing in Greek and Roman times, professional psychology can be traced back only to the turn of the present century. At that time the writings of Sigmund Freud, John Dewey, and others began to attract public attention to psychology, and since then its growth has been spectacular. The American Psychological Association had 15,545 members in 1957, having tripled in size during the preceding ten years, and will probably continue to grow rapidly. Members of the Association represent only about half the total number of psychologists in the United States (Wolfe, 1955). Thus the student who elects to become a psychologist will enter an expanding field. In this chapter we shall examine some of the specific occupations available in the general area of psychology.

Psychology today is composed of a number of occupational specialties. The table on page 508 shows what psychologists do and who employs them to do it (APA, 1957).

These figures indicate a considerable shift since the founding of the American Psychological Association in 1892. At that time its thirty-one members were chiefly academic psychologists—teachers of psychology and men engaged in research into psychological principles. Psychology at that time was almost entirely a “pure” science, still relatively uninvolved with problems of social application, although rapidly growing aware of their importance.

This situation continued until World War I. Then, with the sudden urgency of wartime needs, many academic psychologists became applied psychologists overnight, using and extending psychological knowledge far beyond the applications previously achieved. As a result of its service to the armed forces,

Type of Employer and Employment Function for 12,825 Psychologists
in National Science Foundation Register

(Based on 1954-1955 figures)

Type of employer	Teaching	Administration, supervision	Editing and writing	Individual research	Research direction or supervision	Collection and analysis of statistical data	Test administration and interpretation	Clinical practice	Consulting	No data	Total
College or University	2,551	737	25	495	350	133	265	377	133	54	5,120
Other Educational Institutions	132	216	3	24	23	9	442	187	129	18	1,183
International Government Organizations	1	1			1					1	4
Federal Government, Armed Forces	40	368	23	319	270	64	429	525	66	32	2,136
State or Local Government—Not Educational Institutions	22	265	2	32	39	14	642	439	52	24	1,531
Nonprofit Foundations, Private Hospitals or Clinics	24	75	2	67	32	13	223	306	31	14	787
Other Nonprofit Organizations	16	94	13	54	53	16	75	69	38	6	434
Private Industry—Self-employed	16	29	6	15	16	4	21	232	116	11	466
Private Industry—Employee	128	153	26	87	146	53	107	32	113	19	864
No Data	6	6		3	2		5	10	3	265	300
Totals	2,936	1,944	100	1,096	932	306	2,209	2,177	681	444	12,825

psychology not only enriched itself and expanded into new fields but also gained the social recognition and prestige which established it as a profession.

Applied psychology includes all the fields of psychological employment which are not primarily concerned with the functions of teaching and research, though applied psychologists may, and frequently do, devote a portion of their efforts to research or teaching or both. All applied psychologists, in whatever fields they are active, share the common purpose of solving actual problems of human adjustment. Their ultimate goal is thus the control of some aspect of individual or group behavior. The applied fields which we shall touch on in this chapter are comparative psychology, clinical psychology, counseling and guidance, industrial psychology, psychology and the arts, and military psychology.

In order to describe a psychological occupation adequately, it is necessary to consider both the functions involved in that occupation and its locale of practice, or "work setting." Professional practice in psychology is concerned principally with the following job locales: schools, colleges, business and industrial organizations, governmental agencies,

medical institutions, community agencies, and private practice (APA, 1951). Often there is overlapping in both locale and function. A psychologist who is a specialist in mental test methods, for example, may divide his time between diagnostic testing of patients in mental hospitals and aptitude testing in a vocational guidance center. Or an industrial psychologist may teach a course at a nearby university.

ACADEMIC PSYCHOLOGY

The primary functions of academic psychologists are teaching and research, and their principal locale is the college or university, although research psychologists are also frequently employed by private organizations and governmental agencies. Although academic psychologists are no longer in the majority, the conclusion should not be drawn that their ranks are dwindling. Actually their numbers are continuing to grow even though their relative rate of expansion is less than that of those engaged in the applied fields. And far from decreasing in importance, academic psychology has received increased impetus from the growth of applied psychol-

ogy, for the extent to which psychological principles may be made socially useful is dependent on both the level of theoretical development of the science and the training young men and women receive.

College teaching. The college teacher of psychology is a familiar figure whose classroom functions the student has frequent opportunity to observe. In addition to teaching, preparing examinations, and evaluating students' achievement, the college instructor engages in many professional activities with which the student is not generally so familiar, such as organizing and preparing course material and serving on academic committees or carrying out other administrative responsibilities.

As academic psychologists, college instructors generally devote at least a portion of their time to performing research in various psychological areas. Technical writing may become an important function of the teacher, not only in preparing research reports for publication in scientific periodicals but also in writing textbooks for classroom use and occasional articles for popular magazines. In addition to their academic activities, some college teachers engage in professional practice. This usually is limited to consultation service with governmental agencies or private institutions although some teachers are able to carry on extensive private practice.

Teaching positions as psychologists in accredited colleges and universities, at least for the rank of assistant professor and above, nearly always require a Ph.D. degree. Positions at the rank of instructor are sometimes available for persons who have a master's degree, particularly if they are working toward a Ph.D. Positions of higher academic rank require a well-rounded background in all areas of psychology, as well as in other related areas such as biology, anthropology, physics, sociology, and philosophy. Practical work experience in various applied fields is valuable and is sometimes required for teaching positions.

Teaching in small liberal arts colleges, such as denominational schools, is not so attractive financially as university teaching but offers a real challenge to the psychologist who enjoys creative pioneer work, for in many small colleges the chief function of the psychology department is to serve some other department, such as education (Miller, 1953). Aca-

demie pioneers are needed to develop the teaching of experimental and clinical psychology in such schools. Junior colleges and adult education programs, which have expanded rapidly in recent years, also provide many opportunities for creative work in adapting psychology courses to the special needs of these particular students (Cooper *et al.*, 1953).

For those who prefer to work with younger students, there are increasing opportunities to teach psychology at the high school level. Although a relatively small per cent of the high schools in the United States offer psychology, it is taught in at least forty states (Engle and Bunch, 1956). Often it is not called psychology but goes by such names as senior problems, human relations, or personal adjustment. Usually such courses are electives, but one study found them to be required courses in about 18 per cent of the schools offering them. The same study found that about half of the high school psychology teachers were doing additional psychological work for the school and 6 per cent were teaching in three or more areas other than psychology (Engle, 1951).

It is possible that psychology will come to play a part in the school curriculum at even lower levels. A pioneer course offered to eighth-graders proved valuable as indicated by student comments and enthusiastic acceptance by parents.

After one term of studying a wide variety of topics, the class voted to spend the second term in more concentrated study of the following topics: personality types, superstitions, the psychology of advertising, and boy-girl relationships. The last topic was chosen only by girls on the secret ballot, but the teacher reported that "The boys, after some snickers and groans, raised no objections, when the votes were counted."

Among typical student comments on the course, written anonymously after twenty weeks of work were the following:

"I think this course has helped an awful lot in helping prevent arguments at home and with friends. I wish we could have the course in ninth grade, too."

"I think we have all learned a good deal that others, even our parents, never knew or thought of. It gives us a broader understanding of the people we associate with."

"Since I have been in this class I have lost all belief in superstition" (Patti, 1956).

Careers in research. The most common work settings of research psychologists are the universities and the research foundations; next come school systems, mental institutions, and various governmental and administrative agencies. Actually, experimentation may be applied to all fields of human behavior, and the experimental psychologist may study behavior wherever it is found. As one prominent academic psychologist has explained, "The experimental psychologist is no longer distinguished by a special field of research, or by his technical equipment, or by laboratory simplification. . . . It is not a matter of bringing the world into the laboratory, but of extending the practices of an experimental science to the world at large" (Skinner, 1947).

General research conducted in university laboratories is usually combined with teaching and generally involves the study of basic theoretical problems in such fields as learning, perception, motivation, and emotional behavior. Some colleges also have psychologists on their staffs who conduct educational research projects such as devising and administering entrance examinations, cooperating with the various departments in the scoring and interpretation of achievement tests, and evaluating teaching methods. Such psychologists are sometimes called *educational statisticians* because of their extensive use of statistical methods. Research positions of this nature usually require an M.A. or a Ph.D., as well as a wide background in the principles and techniques of statistics, research methods, and tests and measurements.

Research opportunities within the armed services are many and varied. Psychology was first accepted by the armed services because it made possible better selection and classification of personnel. Today, selection and classification techniques are constantly being refined, with intelligence and aptitude tests being improved and more attention being given to interest, attitude, and personality trait testing. Also, psychological research for the armed services is being carried on in at least three other major areas (Hill, 1955).

1. Development of improved training methods in order to turn out efficient fighters and technicians as quickly as possible. Research in this area includes producing visual aids, developing proficiency tests, and studying ways to improve morale and teamwork. It is the area currently receiving greatest emphasis

2. Improvement of leadership techniques. Data on factors in leadership and leadership training are being assembled through the use of attitude and value questionnaires, personality inventories, peer ratings, motion pictures, and role playing.

3. Design of equipment—application of human engineering principles to all types of military equipment. (See pages 470 and 555.)

During recent years the research psychologist has become an integral member of the mental hospital staff. The *psychophysiologist*, as he is occasionally known, conducts research in many fields, including analysis of both medical and psychological factors in mental disorders, evaluation of methods of psychotherapy, and construction and interpretation of diagnostic mental tests. Although an M.A. is sometimes sufficient for hospital research positions, a Ph.D. is usually required, plus a wide background in experimental psychology, physiology, mental testing, and statistics. Although private mental institutions may conduct a limited amount of research, the greatest employment opportunities are with state and federal agencies, particularly the Veterans Administration and the United States Public Health Service.

COMPARATIVE PSYCHOLOGY

For those who enjoy working with animals, there are opportunities in comparative psychology.

Research in animal psychology. Although most psychological research work with animals is done on university campuses, there are other laboratories, such as the Yerkes Laboratories of Psychobiology, where comparative research is being done. At the Roscoe B. Jackson Memorial Laboratory in Bar Harbor, Maine, a number of projects are being carried on dealing primarily with the interaction of social and genetic factors in producing neuroses and nervous instability in mammals (Ross and Scott, 1953).

Neuroses in animals also form a prominent part of the study going on at the Behavior Farm Laboratory of Cornell University, where the physiological mechanisms underlying emotional disturbances receive serious attention. (See page 184.) A number of sheep and goats have been made neurotic in the course of experiments on the effects of loneliness, monotony, confusion, overstimulation, and

Other centers are studying the effect of radioactivity on animal behavior.

Although most people think of psychologists as working primarily with either white rats or monkeys, a wide variety of animals are used. Psychologists have studied such diverse subjects as mating behavior of the chaffinch, color vision in snakes at the time they shed their skins, learning in the cockroach, reactive inhibition in the meal worm, and motor control in the lobster. There is an increasing trend toward studying a greater variety of forms, and with the research funds now becoming available, more longitudinal studies will be possible, providing more accurate information about the effects of early experience on later behavior.

Manufacturers of tranquilizing drugs such as reserpine and Miltown use mice and other animals to screen their proposed drugs to see if they are safe for human consumption. It is predicted that by 1980 every major pharmaceutical laboratory will have a behavioral testing laboratory. Psychochemistry may also become an established branch of psychology, some studies on the chemistry of the cerebral cortex of rats having already been made. Here is a field for a student who combines a strong interest in psychology with an equally strong interest in the physical sciences.

Psychology and conservation. Comparative psychologists, now engaged primarily in research on theoretical questions, may well find a fruitful field for applied work in the area of wildlife conservation. One group of psychologists has already performed a valuable service in correcting erroneous habits of feeding fish in hatcheries.

When food is tossed onto the surface of the tanks every day, the fish become conditioned to regard the surface splash as the signal for food and to approach the surface. Naturally this response proves fatal after release from the hatcheries, if the fish leap to the surface to meet every fisherman's hook. By adopting a different feeding method and by using electric shock to produce avoidance conditioning to surface splash, psychologists trained fish so well that over long periods of time they survived better than untrained, native trout (Bingham, Adelman, and Maatsch, 1954).

Comparative psychologists could help to solve a number of other wildlife conservation problems. For example, the number of birds

such methods as counts of bird calls or roadside counts made from autos. Results are often highly inaccurate. An understanding of the factors affecting the number of calls, which vary greatly at different times of day, would make for greater accuracy. It has already been discovered that there are more pheasants on the roadside after a dewfall or on rainy or snowy days (Fisher, Hiatt, and Bergeson, 1947).

There is also a possibility that the behavior of wildlife populations could be altered to some extent through conditioning. By further study of this type of learning by wildlife, psychologists might be able to stimulate game to move to more favorable environments when necessary, thus reducing vulnerability to hunters. More favorable habitats could be provided for species that are in danger of dying out. A better knowledge of effective ways of scaring animals might reduce crop damage. Although these possibilities are as yet generally unrecognized, a few administrators of wildlife conservation agencies have indicated that wildlife students need training in psychology (Wildlife Society, 1952).

CLINICAL PSYCHOLOGY

Clinical psychology, the largest and most rapidly growing of all branches of applied psychology, is concerned primarily with adjustment problems in the field of mental health. As was described in an earlier chapter, there are four types of recognized professional mental health workers: psychiatrists, psychiatric nurses, clinical psychologists, and psychiatric social workers. Members of these four professions, working together as *mental health teams*, contribute their different special skills in carrying out our mental health programs.

The title "clinical psychologist" probably meets with the fullest approval within psychology, and also within the allied field of psychiatry, only when it is used to refer to persons who have received a doctoral degree in clinical psychology from a recognized university. Such training usually involves four years in a graduate school, of which one year is spent in supervised practice similar to that of a medical internship. This educational program is designed to equip the individual with the special knowledge and technical competence needed for diagnosis, evaluation,

for research on normal and abnormal personality characteristics.

The clinical psychologist is not a physician and has neither the legal right nor the training to diagnose or treat physical disease or severe mental disorders such as psychoses. His principal area of competence, whether he is employed in a hospital or a social agency or engaged in private practice, is that of personality characteristics—their measurement, diagnosis, and modification.

As a specialist in psychological diagnosis, the clinical psychologist may be called upon to work with patients suffering from all types of mental disorders, but as a therapist he generally is concerned with only the less severe forms of emotional maladjustment. In general, legal restrictions and ethical considerations prohibit any professional worker except a qualified M.D. or D.O. (osteopath) from practicing any form of therapy involving the use of drugs or the administration of any other form of physical treatment, such as surgery or electric shock.

The particular functions of clinical psychologists vary considerably. Clinical psychologists are employed by a wide variety of institutions and organizations including clinics and hospitals, penal institutions, and industrial firms, and many carry on a private practice. Community agencies provide many sources of employment in public health and welfare, law enforcement, and civil service administration, and the federal government offers positions with the Army, Navy, Air Force, Veterans Administration, and Department of Health, Education, and Welfare.

The psychometrist. A specialist in the administration, scoring, and interpretation of standardized psychological tests is called a *psychometrist*. Large numbers of psychologists are employed to perform this single function, which is fundamental to the diagnosis of mental disorders. Although diagnosis also depends on analysis of behavior and symptoms, mental testing is almost invariably required before a complete and adequate description of the case can be made. Final diagnosis is rarely made by the psychometrist, who generally works under the supervision of a psychiatrist or a higher ranking clinical psychologist.

As a group, psychometrists have the least training of any of the professional psychologists, for only a B.A. is usually required,

although an M.A. is preferred. Ordinarily there is little promotion in this area of professional specialization, but with the proper background in testing methods, statistics, and abnormal psychology, the psychometrist may gain valuable professional experience leading to employment in other areas of clinical psychology which have brighter career prospects (Shartle, 1946).

Careers in hospitals. The largest single source of employment for clinical psychologists is the psychiatric hospitals, particularly the state mental institutions and the federal hospitals operated under the Veterans Administration. Their functions range from the routine activities of the psychometrist to highly responsible staff positions involving final diagnosis of cases, proposals for the treatment of patients, and actual therapy. In most psychiatric hospitals the psychologist's primary function is the analysis and appraisal of the patient's "clinical picture" as revealed by personality and aptitude tests. He is often responsible for compiling each patient's case history, including records of test results and personal interviews, description of therapy employed, and comments on general clinical progress. He may also perform clinical research, but opportunities for this type of activity are usually quite limited because of other demands on his time.

Small mental hospitals, too, employ clinical psychologists and in fact offer an opportunity for more varied activities than do the large hospitals. One survey revealed that about half the psychologists employed in forty-seven small hospitals did individual therapy and sometimes group therapy. One was an assistant administrator of the hospital (Miller, 1956). Also, since some small hospitals employ clinical psychologists only part time, it is possible for a psychologist to combine clinical work with teaching or research.

There are increasing opportunities for psychologists in the field of psychiatric training of nurses and internes in federal, state, city, private, and university hospitals, as well as in the Veterans Administration (David, 1955). About three fourths of all medical schools list psychologists as faculty members (Mensch, 1953). Often they combine teaching with clinical services in diagnosis and treatment, or with research, or both.

Although the work of the clinical psychologist is most often associated with psychiatric

institutions, there is a growing demand for his services in general hospitals, where the variety of psychological problems encountered may cover a range almost as wide as applied psychology itself. In a large general hospital the psychologist is usually a member of the neuropsychiatric staff, but he may be called into consultation by many departments, especially pediatrics, dermatology, neurosurgery, and obstetrics. Modern medical men, with their knowledge of the importance of psychosomatic components in many types of physical illness, seek psychological consultation with increasing frequency. Whereas in the average mental institution testing is the psychologist's major activity, only about one fourth of the general hospital

psychologist's time is spent in testing, the rest being spent in consultation, interviewing, and therapy (Schott, 1944).

Child guidance. A specialty occupying a prominent position not only in modern clinical psychology but also in the history of the clinical movement in America is child guidance, which dates back to the establishment of the first psychology clinic at the University of Pennsylvania in 1896 by Lightner Witmer. Witmer was interested in the behavior problems presented by school children, and the purpose of his clinic was to make an "analytic diagnosis" of these problems and discover their causes. He recognized the value of collaboration between psychologist, psychiatrist, and social worker, and the fundamental pro-



The activities of a clinical team in a hospital involve many tasks for the psychologist. In working with an epileptic child, the psychologist's measurements of the patient's brain waves provide necessary information for planning treatment. The psychologist also administers psychological tests, often repeating them to check previous results and to see if progress has been made. Meanwhile, a social worker keeps close contact with the family, making daily reports to the mother and also talking with the child's teacher. From time to time there may be observation sessions attended by nurses and other hospital personnel at which the different members of the clinical team report their findings. Dr. W. G. Lennox, well-known authority on epilepsy, is shown here conducting such a session.

cedures which he instituted form the basic philosophy governing the operation of today's psychiatric child-guidance centers.

The principal psychological functions in child guidance are essentially the same as those in adult guidance, although the actual techniques and procedures with children may be considerably different. The psychologist administers various tests to the child, diagnoses behavior problems, and participates in some forms of treatment, such as play therapy. The adequate handling of children's behavior problems almost invariably includes interviews with parents and sometimes with teachers. The child-guidance psychologist frequently handles many of the clinic's public-relations activities, such as the preparation of articles for newspapers and magazines and lectures on child psychology to parents, teachers, and other interested groups.

COUNSELING PSYCHOLOGY

The professional field of counseling psychology is sometimes confused with clinical psychology. However, although both deal with problems of personal adjustment, the two fields are quite different. Clinical psychology is primarily therapeutic. Counseling psychology is educational. While clinical psychology attempts to solve deep-seated emotional disturbances, counseling psychology deals with problems of normal, everyday adjustment which can generally be solved on an intellectual level. Its aim is to help the individual to analyze his own problems and to arrive at his own intelligent decisions in achieving more mature adjustment. Although a counseling psychologist may attempt to bring about changes in certain attitudes and values, he rarely tries to effect a major change in personality (Hahn, 1955). His locale of practice may be in schools, hospitals, industries, or even prisons.

The counseling psychologist is willing to follow his client beyond the office door and give him concrete aid in making an adjustment. This often means working with other persons and groups as well as with the client and may even extend to taking an active part in the adaptation of social organizations to individual needs. Thus in schools the counseling psychologist works with teachers and administrators, helps shape curricula and extracurricular activities, and influences admis-

sions policies (APA, 1956). In industry he takes part in personnel policies, selection and placement procedures, and training programs. In hospitals he works with all other hospital personnel to develop a total rehabilitation program and may even work with others outside the hospital to develop employment opportunities for patients who are about to be discharged.

The specific types of guidance which the counseling psychologist may offer are vocational guidance, vocational rehabilitation, guidance in schools, guidance with criminals and delinquents, guidance for the aged, and family counseling.

Vocational guidance. The purpose of the vocational counselor is to assist individuals in choosing an occupation and in planning their preparation for it. Vocational guidance is essentially a process of providing the client with information regarding the nature and requirements of various jobs and then, with the client's active participation, working out a plan which is compatible with his abilities and potentialities as indicated in a variety of personality and aptitude tests. The responsibility of final decision always lies with the client; it is the counselor's function to provide the necessary background information.

Employment prospects in vocational guidance work are encouraging, with both general public and governmental agencies becoming increasingly aware of the desirability of the services such guidance can render. Counselors are currently being employed in this capacity by many different types of private and public agencies, including schools and colleges, employment agencies, YMCA's, the Veterans Administration, settlement houses, and other community centers. A bachelor's degree is essential for employment in this field, but an M.A. or a Ph.D. is preferred and is necessary for promotion. Besides a thorough educational background in clinical and vocational psychology and training in measurement and statistics, prospective vocational counselors need college work in education, sociology, economics, and other social sciences.

Vocational rehabilitation. The purpose of vocational rehabilitation is to help people with permanent partial disabilities to prepare for and enter, or return to, productive employment. It is an expanding professional field in which the psychologist functions as a member of a team, much as in the psychiatric clinic.

There are special rehabilitation agencies to serve our large population of disabled veterans, in addition to a far more elaborately administered program, cooperatively executed by the individual states and the United States Office of Vocational Rehabilitation, for the rehabilitation of disabled nonveterans, who outnumber the handicapped veterans by about five to one (DiMichael and Dabelstein, 1946). This extensive state-federal program is aimed at assisting persons with all types of handicaps, whether they resulted from disease, accident, or hereditary factors. Working with such handicapped individuals, the psychologist generally collaborates closely with a supervising physician.

Complete vocational rehabilitation involves four basic phases, or types of operations: diagnosis, counseling, rehabilitation procedures, and placement (Elliott, 1944). Diagnosis is a combined medical-psychological operation—involving medical and psychiatric examinations, interviewing, and psychological testing—to determine the extent of the individual's disability and to appraise his personality, abilities, and capabilities. The counseling phase is essentially the same as with people who are not disabled.

Once the client has been able to work out his problems with the counselor and establish a set of vocational goals, a variety of special rehabilitation procedures may follow, according to occupational decisions made and the nature of the client's disability. Special medical treatment may be given, artificial limbs may be fitted, tools or other special occupational equipment may be supplied, and—most important of all—training is given. A number of professional and other community agencies may cooperate to supply these needs. The counselor seldom takes an active part in this phase beyond referral of the client to the agencies and specialists involved, although he maintains regular contact until final occupational adjustment is made.

The final phase of rehabilitation is placement of the worker in a suitable occupation for which he has been prepared. This is usually accomplished under the auspices of community agencies or employment services to which the counselor refers the client. Rehabilitation is complete upon satisfactory evidence of vocational and emotional adjustment.

Along with the usual guidance skills of interviewing and personality appraisal, the

vocational-rehabilitation psychologist must be skilled in the use of special diagnostic tests designed for use with handicapped persons. He must be familiar with special aids used in rehabilitation, such as hearing aids, prosthetic devices, and Braille, and should have a knowledge of sign language, lip reading, and speech correction. Gaining the confidence of handicapped individuals often requires great patience and skill. For this reason, persons who are themselves handicapped may find their handicaps an asset in this type of psychological work (Shartle, 1946).

Guidance in schools. Within a public school system, the variety of functions which a psychologist may perform is almost unlimited. Vocational guidance is a common function of the school psychologist, especially in high schools, where counseling is given sometimes to individuals but more often to classroom groups. With his special knowledge of educational psychology and learning theory, he may act as consultant in curriculum construction. Schools often encounter problems which can be solved by psychological research, such as studies of the educational value and other effects upon children of motion pictures, television, and radio. As a representative of the public school system, the school psychologist may also be requested to serve on community welfare committees and to speak to parent-teacher associations and other civic groups. In large cities his principal task may be to direct the educational testing program, through which children may be classified and placed in the classes best suited to their abilities. In smaller school systems less time is usually devoted to testing, and greater emphasis is placed on the handling of student behavior problems.

Individual testing and interviewing are limited by the nature of the school situation to the children who need special help. Most students receive help from the psychologist only indirectly by way of the classroom teacher. Corrective work, special adjustments, and provisions for individual differences have to be carried on mainly in the standard classroom situation, and the psychologist's role is essentially that of a technical consultant and adviser to the teacher (Baker, 1942). Where there are special problems, however, the psychologist may work directly with individual students, particularly mentally retarded children, superior students doing inferior work,

children with special abilities, and disciplinary or delinquency problems. Large city systems usually operate special "development schools" for mentally retarded children, and it is frequently the psychologist's duty to recommend the transfer of subnormal students to such schools. Often a psychologist supervises special classes for retarded students and students with special disabilities and handicaps.

The requirements for school psychologists are specific and vary from state to state, although an M.A. in psychology and a state teaching credential are generally demanded, along with courses in statistics, tests and measurements, guidance methods, and child psychology. The demand for school psychologists is increasing in most states; many attractive positions are available, especially in large cities and the more densely populated states where greater public funds are available to educational facilities.

Guidance with criminals and delinquents. Employment opportunities for psychologists in penal and correctional institutions are limited, although in some states there is an increasing demand for such psychological services. In general, greater emphasis is placed upon psychological guidance in juvenile correctional institutions than in prisons. The psychological programs in prisons differ widely from state to state—from complete absence to extensive services available to the prisoner throughout his confinement.

In some states, vocational guidance is an integral part of the criminal rehabilitation program, based on the philosophy that every man should be returned to society a useful citizen (Martin, 1946). In the state of California, for example, a man who is committed to a penal institution is processed in a reception unit before being transferred to a prison. The reception units, called Guidance Centers, are staffed by psychiatrists, clinical psychologists, educational and vocational counselors, and sociologists. Here each man is given a complete psychiatric and psychological diagnosis, upon which recommendations are made for the conduct of his individual prison "career," with special emphasis on the kind of vocational training he is to have. The functions of the psychologist in this diagnostic process include an evaluation of the prisoner's personality, intelligence, educational achievement, aptitudes, and previous vocational experience.

In most prison systems the functions of the psychologist—besides routine testing and per-

sonality analysis—include educational, vocational, and personal guidance, available on the prisoner's request. The psychologist also consults with the prison staff on improvement of rehabilitation and training methods, methods of handling problems, ways of improving prison morale, and proposals for parole. He may be expected to compile and maintain case records on prisoners. Although the juvenile correctional institution presents a somewhat different picture and requires the use of special methods better adapted to handling children, the counselor's general functions in the two types of institutions are essentially similar.

On a questionnaire sent to superintendents of eighty-four juvenile institutions, psychological work was regarded as essential by the superintendent of every institution which employed a trained psychologist (Giardini *et al.*, 1942). In response to a question asking what they thought the psychologist's most valuable services were, the superintendents gave the following most frequent replies:

1. To help the administrator gain an understanding of the inmates of the institution.
2. To aid in the treatment of behavior problems.
3. To make recommendations in educational and vocational programs and aid in their execution.
4. To aid in the selection of prospective parolees.
5. To help train the staff to understand the inmates and handle them more effectively.

Guidance for the aged. Individuals of all ages have vocational, intellectual, social, emotional, and recreational needs (Lawton, 1942). Inability to satisfy these fundamental needs in our fast-moving, youth-worshiping society is the source of most of our old people's adjustment problems. With the proportion of old people steadily growing, it becomes increasingly important that ways be found to help them meet their needs.

Psychological counseling for the aged is a branch of the science known as *gerontology* (from the Greek word meaning "an old man"), which is the study of the phenomena of old age. The greatest employment opportunities in this field of guidance work are in old-age homes, most of which are privately operated. The psychologist's principal functions are to promote adjustment and healthy human relations among the people in the home and to supervise programs of recreation and occupational therapy. In many localities there also are community centers for older people which

provide employment services and recreational facilities and often conduct classes in a wide variety of subjects. Psychologists employed in these agencies counsel older people on personal and vocational problems, recommend suitable new interests, and organize hobby and other recreational activities, such as games and amateur theatricals.

Family counseling. The aim of the family counselor is to better family relations, and he may be called on for help in matters ranging from problems of child management and marital relations to aid in legal, financial, or educational problems (Bennett, 1942). Thus family counseling is a broad, general field depending largely on the interviewing technique. The client, with the counselor's assistance, works through his problem and arrives at his own solution or plan of action. Because of the diverse nature of the problems his clients present, the family counselor must be thoroughly familiar with the help all the community agencies can give and is liberal in his referrals when a particular need can best be met elsewhere.

Private practice in family counseling, as in all forms of guidance work, is not common. Such services are more frequently offered by social welfare agencies, schools, guidance clinics, churches, and business and industrial organizations.

INDUSTRIAL PSYCHOLOGY

The field of industrial psychology, considered broadly, includes the application of psychological knowledge and methods not only to business and industrial problems but to all types of organizations whose operations involve the cooperative efforts of large groups of individuals. Both the government and the armed forces, for example, have made good use of the industrial psychologist. The fundamental problem in industrial psychology is that of *efficiency*—of producing the greatest results with the least time, effort, and cost. In attacking this problem the psychologist uses approaches which involve *human relations*. These approaches are of two kinds—those concerned with personnel within the organization and those concerned with the customer, the public, and society as a whole (Starch, 1942).

Prospects appear favorable for the increased use of industrial psychologists, for many companies who do not yet employ them

regard them as valuable (Stagner, 1946, Tiffin and Pievratil, 1956). Companies who employ one thousand or more individuals use industrial psychologists to a greater extent than do smaller companies and consider them useful in more personnel activities.

The training of an industrial psychologist often involves a period of internship. In fact, a survey of members of the Division of Business and Industrial Psychology of the American Psychological Association showed that 70 per cent favored an internship period of one year, during which time the trainee would gain experience in an actual industry in such activities as test construction and validation, employee training, interviewing, counseling, and other phases of industrial psychology (Wilson, 1956). A medium-sized private business or industry was regarded as the best place to gain this experience.

Another form of on-the-job training, used in some companies which do not approve of the internship program, is actual work experience with the company in such positions as member of an industrial engineering group or "foreman in training" in factory work before transfer to the personnel department (Uhrbrock, 1955).

Personnel interviewing. The psychologist engaged in personnel work in any kind of organization, whether a private or public enterprise, is interested in producing a smooth-running, happy, and efficient working unit. His task involves, on the one side, the use of scientific procedures in selection, classification, and training and, on the other, the maintenance of employee morale and the optimum satisfaction of the workers' economic and psychological needs.

An employee's first contact with an organization in which he is going to work is generally the employment interview, where the psychologist's task begins. Large organizations often employ psychologists full time to perform this single important function of selection and classification, which is basic to industrial efficiency. By interviewing the applicant personally, having him fill out standard forms, and administering and interpreting aptitude and personality tests, the employment interviewer obtains a background of information which enables him to classify the applicant and determine his suitability.

Employment interviewers sometimes work in private or public employment offices which operate as a combined service to employers

and job-seekers. In such offices, the interviewer matches the job-seekers' qualifications to the job requirements submitted by various employers and refers applicants to the appropriate employers. Employment interviewing may require a B.A. degree in psychology with work in testing, interviewing, and industrial psychology, although persons with no formal psychological training are often employed. This is an "entry occupation" which may lead to higher positions in general personnel administration (Shartle, 1946).

Personnel orientation and training. After the employee has been hired and assigned to a job in the organization, the next phase of a complete human relations program—especially in large industries—is orientation. This involves both formal and informal methods of acquainting the worker with his job and with the organization, familiarizing him with company policies and benefits, and giving him a feeling of membership—of "belonging" to the group. This task may be one of the duties of the employment interviewer or may be assigned to a personnel psychologist, who may conduct special orientation classes on company time for the benefit of new employees.

In some organizations on-the-job training is an important part of the human relations program. Personnel specialists frequently supervise such industrial training, using specialized techniques in helping workers to learn new jobs, new procedures, or operation of new machines.

Foremen and supervisors, who are the link between management and labor and are in direct contact with the employee and his work, are key personnel in the establishment of good human relations. Supervisor training, therefore, has become an important function of the personnel psychologist; he uses his psychological knowledge to increase the supervisor's skill in maintaining worker morale and efficiency. Supervisor training today often resembles informal group counseling in which supervisors discuss the psychological aspects of their jobs and, with the psychologist's guidance, cooperate in working out problems arising from their responsibilities, such as how to prevent accidents or maintain discipline.

Labor relations. A wide variety of techniques and functions are involved in establishing and maintaining employee satisfaction and harmony between employer and employee. A frequent task of the labor-relations specialist is that of negotiating with em-

ployees in management-labor disputes. He confers with employee representatives, hearing grievances, arbitrating disagreements, and devising procedures for settling problems relating to such matters as wage or hour changes and union policies. Personnel psychologists frequently recommend changes in wage-hour scales to management and establish promotion and retirement procedures. To contribute to increased worker satisfaction, personnel departments in large business and industrial concerns organize and promote recreational activities such as ball teams and bowling clubs, employee magazines, company cafeterias, employee lounges and club rooms, and adequate sanitary and medical facilities.

Personnel research. The fostering of good human relations in industry is still a relatively new profession which, outside of a few major corporations, received little attention by management prior to World War II. As such, it is a field still lacking refinement in many of its techniques and presenting numerous problems that require exploration and research. Nearly all large industrial enterprises, as well as federal and state governments and the armed forces, now maintain research psychologists to conduct studies related to human relations and personnel management.

A principal industrial research function is *job analysis*, or the analysis of specific jobs in terms of the operations involved and the abilities and training required. From a job analysis, the personnel research psychologist prepares a *job description* which states the specifications and the requirements employees need to fill the job. Job descriptions are used extensively by employment interviewers and other personnel workers in selection and training of workers and in establishment of wage scales.

Another form of industrial research is *time and motion study*, which is the step-by-step analysis of the hand and body motions used by the worker to perform a specific task. (See page 472.) The function of the time-and-motion analyst is to increase the efficiency of work methods by establishing the best method of performing the job with the greatest efficiency and least effort. Personnel research also involves such diverse activities as preparing and evaluating training programs, investigating accident proneness, compiling and analyzing labor statistics, and improving employee motivation and work satisfaction.

Public administration. In a broad sense industrial psychology itself is the psychology of administration—of cooperative action to achieve common purposes. The term *public administration*, however, is given to the activities of the executive groups administering national, state, and local governments and public agencies. As in industrial management, the fundamental problem of public administration is efficiency. The task of the psychologist in government service is the application of human relations methods to the activities of executive agencies.

Many psychologists have chosen to work in this field. At least one third of the members of the American Psychological Association, or about 4500, are employed by governmental agencies—about 2000 by the federal government, 1500 by cities and counties, and 1000 by state governments (Rogers, 1956). This does not include those connected with city or state institutions of higher learning, which would bring the total to nearly half the APA membership.

This large group of psychologists faces a number of special problems. They are often stereotyped as "bureaucrats" by the public and in many cases have not yet gained full acceptance either by fellow civil service employees or by colleagues in universities. Also, they are often hampered by administrative "red tape" from making the fullest use of their professional skills. A suitable program of public education would help somewhat in alleviating these difficulties, and the public administration psychologist himself can do much to make his work better understood by the public through professional and other organizations to which he belongs.

In government, as in business, one of the psychologist's chief contributions is in selection and classification. In government this task is handled primarily through civil service systems, which employ large numbers of psychologists as personnel technicians and directors. Psychological positions in civil service administration principally involve constructing selection tests and conducting interviews and examinations for all types of government positions falling under civil service jurisdiction. The position of civil service technician requires at least a B.A. degree, with work in statistics, testing, and industrial psychology. Some experience in various types of personnel work is also generally required.

Psychologists are frequently hired by executive agencies of the government. The Department of Agriculture, for instance, has many psychologists on its staff for the purpose of obtaining and evaluating farmers' reactions to agricultural problems and proposed remedies in order to develop administrative programs which fit the needs and desires of the people. Such work has furnished the government with a wealth of information not only on the soil and the crops it yields but also on the man who tills the soil and on his way of life, standard of living, needs, and desires.

Public health is another area of public administration in which the psychologist has contributed his technical ability. Here he has been active in constructing health education programs and supervising methods of public instruction in better health and sanitation methods. He may study social conditions and determine the most appropriate methods of motivating the public toward desirable action. Another important psychological task in any type of public education program is to evaluate the effectiveness of various media, such as pamphlets, newspapers, posters, movies, and television (Derryberry, 1942).

Public libraries, particularly in the largest cities, may employ a full-time psychological consultant. Libraries which employ hundreds of people on their staffs and daily serve thousands of readers and information-seekers face many problems of personnel administration and public relations. Library administration is faced with the task of relating its policies, procedures, and services to the educational, recreational, and personal needs of society. The psychologist's functions in the library include personnel administration, book selection, and staff training in human relations. Libraries sometimes offer vocational guidance as one of their services. Another form of guidance encountered in the library situation is *biblio-therapy*, which involves recommending books that will foster insight into personal problems and help provide a basis for their solution.

The new field of *traffic engineering* is making good use of psychological services. A city or state traffic engineer's department is responsible for many different duties including designing and constructing highways, posting street signs and markings, routing traffic, and timing signals for the most efficient flow of traffic. In addition to the engineer's skills, good traffic engineering requires a before-



Since so much of a child's learning takes place through play, it is important that his toys allow him to use his particular level of ingenuity without being so complex that they frustrate him. In a project sponsored by the Educational Toy Institute of New York, toys are tested for their "Interest Index" (above). Preliminary models are built on the basis of what is known of children's abilities and interests, and those found to have a high interest index are changed in color, shape, size, design, and so on and tested again until the best model for each is found. Often the same toy will be played with differently by children of different ages. For example, the add-a-load truck (below) appeals to four-year-olds chiefly as a vehicle for loading and hauling. The five-year-old begins to count the spaces on each block, while the six-year-old can use the toy to do simple adding and subtracting.



hand knowledge of human reactions to new designs and highway innovations. As a consultant to the traffic engineer, the psychologist performs research on such problems as driver behavior on various types of highway designs, judgment and reaction time, and sign legibility, and recommends designs best suited to the man behind the wheel (Forbes, 1941).

Public opinion polling. Accurate determination of prevailing public opinion, attitudes, ideas, and reactions is fundamental to many areas of social control. Opinion polls employing psychologists are supported by a number of different types of agencies and organizations for varying purposes. The largest and greatest number of polls and social surveys are conducted by the federal government, whose most methodical and extensive survey is the United States Census. Many newspapers and magazines present the results of polls on questions of current interest as regular features. Advertising has come to be an especially active field of opinion polling in recent years.

Although interviewing is the basic operation involved in opinion polling, this function is generally performed by personnel who are not themselves primarily psychologists. Actually, a polling organization is usually an enterprise with a large staff of interviewers, clerks, and general office workers, in which the psychologists are in the minority but maintain the key responsible positions. The public-opinion psychologist is essentially a technician in sampling techniques, scientific methodology, and statistical analysis. Long before the actual interviewing begins, the polling technician is at work determining the nature of the population to be interviewed and framing the questions to be asked. At the close of the interviewing he tabulates and analyzes the data and prepares interpretive reports of the results.

Public-opinion psychologists often specialize in a branch of polling known as *market research*, which is closely related to advertising. As you saw in Chapter 16, present-day emphasis is on mass motivation—*why* people buy or vote the way they do. Market research is concerned with determining the buying habits and needs of people and their attitudes and reactions toward various products, in order to obtain greater sales and public satisfaction. Through the results of market research, manufacturers are able to

produce goods which, instead of requiring "high pressure" advertising and selling methods, will "sell themselves." Automotive corporations, for example, can determine in advance of manufacture the public's preferences in regard to such matters as fender styling and exterior coloring. They can then incorporate these preferred features into their forthcoming models with confidence of success.

Scientific, accurate opinion polling has become a highly technical field requiring at least an M.A. and usually a Ph.D. degree, with a broad background in psychology, sociology, economics, or other social science. A solid grounding in statistics and scientific methodology is usually essential, as is added experience in business, although in many cases it has been found that this can be supplied by a practical colleague with whom the technician works closely.

PSYCHOLOGY AND THE ARTS

Art is among the oldest forms of human expression and communication. The art of primitive man has provided us with much of our knowledge of prehistoric life, and the music, drama, literature, and sculpture of the ancient civilizations remain as monuments to the Muses. Through his works of art man is able not only to communicate his ideas and images but also to express his emotions and to provide enjoyment for his fellow man.

Psychology in the art museum. The advantages of psychological consultation in organizing art museum services have been well demonstrated in institutions such as the Cleveland Museum of Art (Lark-Horovitz and Keith, 1942). Here the psychologist analyzes the interests, reactions, and needs of the museum visitors and from his findings organizes museum talks and classes, advises guides on the needs and desires of the public, and recommends appropriate tags and explanatory notes to be attached to art objects. His goal is to secure greater response on the part of visitors and greater satisfaction with the museum's services.

The psychologist is especially valuable as an adviser in a museum's educational and recreational programs. Many art museums offer creative art classes, which serve many purposes including occupational and emotional therapy. The psychologist can advise the instructors of such classes in appropriate

methods of approach and training. Often, museum classes are offered to children as part of an art appreciation program. The psychologist's knowledge of teaching methods and child psychology can contribute much to such enrichment of children's cultural backgrounds.

Psychology in the music school. Psychology has made many contributions to the measurement of musical aptitude. In the school of music such tests are invaluable, but the psychologist employed in a conservatory has a number of functions beyond testing. As a counselor, he may offer guidance to students concerning their vocational plans and personal affairs. He may function as an educational adviser to the faculty, suggesting special teaching techniques. He may also act as a part-time instructor, teaching courses in psychology and esthetics. Finally, the field of musical expression offers many interesting research problems for the psychologist such as establishing the best techniques for teaching music, refining tests of musical talent, and studying the emotional and esthetic aspects of music.

Psychology in broadcasting and motion pictures. Psychologists are employed in several capacities by most major broadcasting companies. Particularly in the preparation of educational and children's programs, the psychologist is equipped to offer valuable advice and recommend material which will be in the best interests of children (Jersild, 1942).

A larger area of psychological employment in the entertainment domain is *audience research*, which is an active field in both broadcasting and motion pictures. The aim of the audience-research psychologist is to determine and analyze the public's reaction to various forms of entertainment and to specific programs and motion pictures. Before an important motion picture or series of television plays is produced, for example, a study is made to determine whether or not the dramatic theme has desirable entertainment value. The title which a movie or a television series bears is often the result of polls of public opinion. Testing audience reaction sometimes involves the use of elaborate techniques, such as measuring the psychogalvanic skin responses of individuals who are watching a motion-picture preview in order to determine the emotional impact of a particular dramatic scene.

Particularly since World War II, the armed forces have employed psychologists both as civilian consultants and as personnel in military units for extensive psychological programs. Among the functions of military psychologists, those involved with troop morale and the methods of so-called "psychological warfare" have received wide publicity but actually represent only a minor proportion of psychologists' contributions to military efficiency. Research opportunities in the armed forces have already been mentioned (page 456). Active programs are underway in the refinement of tests for the selection and classification of military personnel and in the development and evaluation of increasingly efficient training procedures. Studies of factors like vision and fatigue in the performance of specialized military tasks have also yielded valuable findings (Britt and Morgan, 1946).

During World War II many unusual problems of equipment design gave rise to a new field of psychology known as engineering psychology, or human engineering, which brought military psychologists into close collaboration with engineers and physicists. Engineering psychology is concerned primarily with the design of weapons and equipment so that they can be operated with a minimum of error and a maximum of ease and efficiency. (See pages 470-475.) Military psychologists during the war assisted in the design of many important instruments of warfare, including aircraft cockpits and instrument panels, gunsight controls, radar consoles and scope faces, voice communication systems, underwater sound-detection systems, and stereoscopic range finders. Research has continued on a relatively large scale in this area of military psychology since the war (Fitts, 1951).

REGULATION OF PSYCHOLOGISTS

With psychology's achievements so far and its promise for the future, the problem of regulating the profession has become a mat-

ter of grave concern. For with its great need for psychological services, society too often finds itself the innocent victim of pseudo-psychologists, inadequately trained "psychologists," and mercenary charlatans.

THE NEED FOR REGULATION

The regulation of psychological practice is a social and professional necessity, from the point of view of both the public and the psychological profession.

The welfare of the public. A primary need for regulation of the profession is to protect the public from "quacks." A "quack" is someone engaged in the professional practice of psychology, or operating under the title of "psychologist," who is not properly qualified in the field through training and experience. The incidence of quacks in the United States has been estimated by the American Medical Association at upwards of twenty-five thousand. Often their counsel is unsound, detrimental, or unethically motivated. Furthermore, contact with them serves to delay proper treatment and hence is doubly dangerous.

Financial profit represents the primary objective of the majority of these psychological racketeers. A recent study of the operation of quacks in the city of Los Angeles showed the average annual income of these "mind meddlers" to be fifteen thousands dollars, with some as high as fifty thousand. Their nationwide annual take is an estimated four million dollars.

Legal control of this menace to the public's welfare is very inadequate. Only a few states and a few cities have enacted legislation designed to correct the situation. Though their practice is morally illegal, these quacks usually operate within the law, giving themselves some semblance of professional standing and prestige through the display of official-looking documents, the publication of misguiding but convincing advertisements, and the use of a misappropriated title.

These charlatans may often be recognized by the fact that they advertise, whereas qualified psychologists do not need to; they also "guarantee" their services, or use high-pressure sales methods (Lawson, 1950). They tend to talk too much about their degrees (usually from unrecognized schools). They are prone to speak of their own successes and

to disparage recognized psychologists or professional organizations. If they wear turbans or gowns or speak of vibrations, mystic symbols, or unusual "powers" of insight, they are sure to be fakers.

Unfortunately, the very methods which brand the self-styled "psychologist" a quack in the eyes of the well educated make him all the more attractive to the uneducated man who locates a psychologist by consulting the classified section of the telephone directory. Only through legislation can fakers of this type be suppressed. Yet only a few states have adequate laws regarding them.

The welfare of the psychologists. In a large measure the public's frequently skeptical conception of psychology and psychologists is caused by experience with unscientific and unethical operators purporting to be psychologists or to be using psychology. Adequate regulations aimed at preventing unqualified individuals from assuming the name "psychologist" would reserve for bona fide members of the profession a title by which the public could identify them. Psychologists would no longer be identified with the faults of quacks.

Regulation would also prove an economic benefit to the profession since it would protect members of the profession from competition by unqualified individuals. Finally, adequate regulation would serve to create new opportunities for psychologists. Clear legal requirements for practicing in a specified field would encourage new employers to avail themselves of the service of applied psychologists.

THE MEANS OF REGULATION

If we grant the need for regulation, the next question is how this regulation shall be accomplished.

Self-regulation. The profession can regulate itself. This is a first step indicating the "coming of age" of any new field. Such organizations as the American Medical Association began their standardization and clarification of rights and limits in this direct manner.

A Code of Ethics has already been formulated by American psychologists. More specific steps toward regulation have also been taken by the American Psychological Association. These include the establishment of the

Education and Training Board and the creation of the American Board of Examiners in Professional Psychology, which vouches for the qualifications of psychologists. Recently another step was taken by making low-cost professional liability insurance available to qualified psychologists (APA, 1955). A serious limitation of this method is that enforcement measures can be taken only within the membership of a given organization and does not reach the quacks.

Regulation by public opinion. The public informally regulates the profession of psychology in several ways. The public's attitude toward psychologists and their work compels the profession to strive for and maintain healthy public relations. This was evidenced by the establishment of a Committee of Public Relations within the American Psychological Association in 1945 to study the question of improving public attitudes. Many regional and local psychological organizations have set up similar committees. Early in 1948 the advantages of a publicity expert within the APA were outlined. Among the duties of such an official would be the initiation of a general educational program telling the public of the services psychology is prepared to render; he would also seek to devise effective ways of presenting the psychologist and his activities to the public in a favorable light. Again, however, these procedures benefit those within the organization but do not prevent the quacks from continuing to operate.

Legislation as a means of regulation. The most feasible answer to the problem appears to be some type of legislation—public statutes regulating the professional application of the science of psychology. Legislation has the significant advantage that its provisions are legally enforceable. And the limitations and requirements of the enacted provisions, in turn, serve to guide the formulation of policies with the profession. Thus such crucial factors as the amount of training and experience required for permission to enter the professional practice of psychology would be in every case at least partially determined by a clear criterion—the fulfillment of specified legal requirements.

Types of legislation. Legislation aimed at the regulation of psychology may be listed under three broad types: (a) registration statute, (b) certification bill, and (c) licens-

ing bill. The last two types have in some localities been combined into a "certification and licensing" bill.

A registration bill is one that merely requires that those individuals engaged in a specified professional activity be registered with the enacting government. For a relatively small fee the registrant then receives a permit to practice in the profession. As little or no attempt is made at fixing standards of required training or experience, the ineffectiveness of such a procedure is immediately apparent. All too often no check is made as to the registrant's personal and moral fitness to qualify as a practitioner of any kind.

The certification bill represents a definite improvement over the registration bill. Such a bill provides for the restricted use of a designated title to apply only to those individuals who, upon applying, meet specified standards of qualification as to training, experience, personal fitness, and so on. It has been pointed out that "certification" means essentially that other psychologists approve of what a given psychologist is doing. Thus certification meets one of the needs of the profession by setting up a title whereby the competent psychologist may be readily identified and distinguished from the psychological quack. At the present time certification laws exist in only nine states. They are California, Connecticut, Maine, Maryland, Minnesota, New Hampshire, New York, Virginia, and Washington.

For certification laws to be of any practical value, however, there will need to be a tremendous program of education of the public as to the difference between a professional clinical psychologist and someone with a similar title who does not have adequate qualifications. For even certification still leaves unqualified individuals free to operate so long as they do not use the certified title. Investigation indicates that at present certification alone makes little difference in the public patronage of quacks.

Licensing legislation goes one step further by requiring that all individuals engaged in the professional practice of psychology possess a valid license issued on the grounds of prescribed qualifications. Such a plan makes the practice of unqualified persons illegal and punishable by law and thus seems to represent the most effective means of regulating the profession. Licensing laws exist in

Arkansas, Georgia, Kentucky, and Tennessee (APA, 1957.)*

The problem of definition. One of the first considerations in the complex job of regulating a profession by legislation is that of defining terms. To license the practice of psychological techniques, the scope and limitations of "psychological activities" must be defined. And this definition must be somewhat arbitrary. Is a father's advice to his son to be a breach of the law? Few would say so. It is apparent that the practice of psychology needs to be defined quite narrowly. Yet a legal definition which covered only those who administered Stanford-Binet Tests, though easily enforceable, would be of little use. Thus the definition must not be too narrow either. It must be broad enough to cover all who have a right to the title but limiting enough to maintain the necessary standards. In addition it must be flexible enough for the selection board to meet the existing supply and demand situations realistically.

The problem of definition has been the biggest stumbling block in getting legislation through so far. For example, any use of the terms *therapy* or *psychotherapy* is strongly objected to by the American Medical Association. So also would be any reference to healing or curing or alleviating distress or treating disorders. On the other hand, nothing in the definition of "psychologist" must operate to interfere with the present legitimate counseling and guidance activities of clergymen, lawyers, teachers, or certain marriage and family counselors. The narrow path left to psychologists in defining their new field must be traced out through established rights and status quos in a manner which, until now, has not been done satisfactorily. Perhaps the greatest hope for solution lies in the creation of integrating and coordinating state boards of health and welfare with the authority to cut through the red tape, deadwood, and precedent and redefine all of these related services.

* Though classified here as a certification law, the New York law actually has some of the aspects of a licensing law. While it fails to define "practice of psychology," it does prohibit anyone engaging in the practice from calling himself a psychologist unless he is certified. He does not have to call himself a "certified psychologist" to be in violation.

Enforcement. Any law is useless unless it can be enforced. There must be provisions specifying penalties for violation of any of the bill's provisions. This is the purely legislative aspect of enforcement. A second aspect of the problem concerns the apprehension of violators. Individual psychologists and psychological organizations are in a position to report the activities of many unqualified practitioners. The cooperation of the Better Business Bureau also aids in the enforcement of the bill. But the program can succeed only as the general public is educated to recognize quacks and to cooperate with the authorities in putting them out of business.

Privileged communication. It is the duty of the ordinary citizen to report to the authorities any knowledge he may have of another person's having committed a crime. Otherwise, he becomes an accessory after the fact. However, certain professional groups, notably lawyers, are permitted to hold communications from their clients in strict confidence. This is known as privileged communication. Since the psychologist or the psychiatrist needs to obtain detailed information about a patient's or client's past in order to help him overcome emotional disturbances, privileged communication seems to be a must for the successful practice of psychotherapy. Yet only eight states grant psychologists this right. They are Arkansas, California, Georgia, Kentucky, New Hampshire, New York, Tennessee, and Washington. The psychiatrist, being a physician, fares much better, though even the physician-patient privilege is recognized in only twenty-seven states. Legislation granting the right of privileged communication is another type which is sorely needed.

FINANCIAL AID FOR GRADUATE STUDY

Perhaps you are not fortunate enough to have parents who can afford to keep you in school for several years after graduation. In that case you will be interested to know that

a number of fellowships, scholarships, and assistantships are available for qualified students who want to do graduate work in psychology. In applying for one of these you must also apply for admission to the desired graduate school. The qualifications usually include academic ability or promise of success in scientific research, as shown by achievement at the undergraduate level and by recommendations from persons in whom the admitting department has confidence (Moore, 1956). Sometimes a test, such as the Graduate Record Examination, must be taken. Usually, course requirements in psychology are relatively few. In fact, many departments prefer that the student not complete many courses, especially technique courses, as an undergraduate. Most departments expect the graduate student at least to have completed undergraduate courses in introductory or general psychology, experimental psychology with laboratory, and statistics.

Most fellowships and scholarships require no service to the department but are outright grants. Assistantships, however, are forms of employment, which may require teaching or assisting in research. Sometimes the holder of a scholarship or assistantship is exempt from tuition also.

It is customary for the Education and Training Board of the American Psychological Association to publish an annual report on the educational facilities and financial assistance available for graduate students. This usually appears in the January issue of the *American Psychologist*, and interested students may obtain reprints from the office of the American Psychological Association for a small fee. This list includes a large number of colleges and universities (150 in 1956) in all parts of the United States. Since schools which do not send up-to-date information to the APA are not included, the list varies somewhat in number from year to year. In each case the available scholarships and other stipends are listed, as well as amount of tuition, application date, and names of persons to whom applications for admission and for stipends are to be sent. Fields in which master's and doctor's degrees may be obtained are given also.

SECTION THREE

FRONTIERS IN



**STATISTICAL VERSUS CLINICAL
APPROACHES**

**THE STRUCTURE OF INTELLECT, TEMPE
AMENT AND PERSONALITY**

HUMAN MOTIVATION

**LEARNING THEORY, PSYCHOANALYSIS,
AND COMMON SENSE**

**DEVELOPING A PSYCHOLOGY OF
LEARNING**

THINKING

GROUP PROCESSES

**OPINION AND COMMUNICATIONS
RESEARCH**

ENGINEERING PSYCHOLOGY

**THE BRAIN AS AN INTEGRATING
MECHANISM**

Thirty years ago Gardner Murphy wrote: "From colour theories to defence-mechanisms, from the functions of a white rat's vibrissae to the mystic's sense of unutterable revelation, from imaginary playmates to partial correlations—wherein lies that unity of subject matter which leads us to speak, compactly enough, of 'contemporary psychology'? From behaviourism or Gestalt psychology to psychoanalysis or the objective measurement of character, the eye wanders over an interminable range of experiments, measurements, hypotheses, dogmas, disconnected facts, and systematic theories. In a sense it is true to say that through all this vast mélange the very birth-cry of the infant science is still resounding. In another sense psychology is as old as occidental civilization, and all these seething multitudes of investigations and opinions spring from an inconceivably rich and variegated history" (Murphy, 1928).

These words are still true today. Psychologists continue to investigate phenomena that have concerned man from the beginning of time; yet still they must often rely on hunch and intuition in selecting a specific problem for research and in planning their variables and controls. They do not have the physicist's secure base of internally consistent theory from which to work in charting new areas. Though good research in any science turns up more questions than it answers, the questions that grow out of psychological research are often vague and unclear and fail to point to definite "next steps" in investigation.

In the section that follows, ten leading psychologists and sociologists have written briefly on what they consider to be important "frontiers" in their fields of specialization, pointing out the trends in theory and research and the critical questions that need to be answered. In every one of these fields there have been major breakthroughs in recent years. Yet, significantly, not one of them was completely neglected thirty years ago, and we predict with confidence that none of them will be completely understood thirty years from now. Our knowledge becomes broader, our concepts more accurate, our picture more complete, our approximations closer to the truth, but no science can ever be written off as "finished" or "complete" and, perversely, we would be disappointed if it could, for there would then be no further "frontiers" to explore.

STATISTICAL VERSUS CLINICAL APPROACHES TO THE UNDERSTANDING OF HUMAN BEHAVIOR

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The beginning student must be a little awed not only by the range of subject matter of psychology but also by the very different methodologies used by psychologists in their studies of behavior. Further reading in the field and increased familiarity with the day-to-day work of psychologists reveals an even wider span of methodologies and an unfortunate tendency—probably unavoidable at the present stage—for psychologists to hold strong but not entirely justified convictions regarding the relative merits of different methodologies.

While many of these differences of opinion regarding methodology involve only a few specialized research workers, there is one broad methodological issue on which most psychologists will be found to be definitely on one side of the fence or the other and, furthermore, to hold rather strong and often forcefully expressed attitudes. In its simplest form this issue is: to what extent and in what ways is the psychologist, as a person, an essential or critical component of the total science and practice of psychology? Do the unique characteristics and complexities of the subject matter of psychology require that the psychologist himself operate as an instrument for observing and recording data and as the "computer" which analyzes and integrates the data so that meaningful interpretations can be made?

The two opposing positions with respect to this broad methodological issue are generally labeled "clinical" and "statistical." Adherents of the "clinical" position argue that the intuitive, global, dynamic approach is necessary for understanding the meaningful complexities of behavior; they are likely to refer to statistical methods as atomistic, mechanical, and blind and to their users as cold, insensitive, or insecure persons who use apparatus and statistical procedures as a means of avoiding close interpersonal relationships. Adher-

ents of the statistical position, on the other hand, believe that in spite of the inherent complexities of subject matter, psychology must follow the lead of the other sciences in relying primarily on objective techniques of observation and the rigorous application of mathematics in the analysis of data; they are apt to call their clinical colleagues artistic, nonscientific, or even muddle-headed!*

Perhaps the best simple example of these contrasting points of view occurs in connection with the selection of students by a college confronted with more applicants than it can admit. The statistically minded psychologist takes the position that the best solution to this problem results from determining the correlations between a number of predictor variables (e.g., high school grades, scholastic aptitude test scores) and an index of success in the college and, having done so, predicting the probable success of each applicant on the basis of a regression equation which objectively treats each applicant by the same formula. Because of the lack of perfect correlation between the predictors and success in college, he freely admits, the resulting predictions will not always be correct but he insists that the overall proportion of good decisions is thus maximized.

The clinician, confronted with the same practical problem of selection, argues that the college should treat each application as a unique case. He would recommend the collection of additional background material (e.g., an autobiography and probably a personal interview with each applicant). Then, on the basis of all information and impressions, the clinician would attempt to evaluate the applicant as a potential college student and predict his success in college. As a clinician, he would permit himself to vary the weight or emphasis given to predictor variables for different applicants depending on how he formulated the individual case.

* A much more extensive list of honorific and pejorative adjectives used in this controversy will be found in the excellent monograph by Meehl, *Clinical vs. Statistical Prediction*.

Offhand, it would seem that the second approach, using much more information and involving an effort to understand the applicant as a person, would lead to more accurate predictions. Unfortunately, such does not seem to be the case. Several studies comparing the statistical and clinical approaches fail to show any predictive superiority for the more time-consuming clinical approach (Mechl, 1955). Apparently, in his sincere attempt to incorporate the additional potentially predictive information and to weigh it appropriately in arriving at his judgment regarding each applicant, the clinician introduces sufficient additional error to offset any potential added value in the clinical approach to prediction.

BACKGROUND OF THE CONFLICT

In a large measure, these two markedly divergent positions are the result of the historical merger in psychology of the earlier, equally divergent approaches to an understanding of nature represented on the one hand by the humanities and on the other by the developing disciplines of the natural and physical sciences. The conflict continues because neither approach has yet proven its clear-cut superiority in finding better answers to the problems with which psychology is concerned. The problem has been further aggravated by the public demand for psychological services, which forces the applied psychologist to choose techniques for the task at hand regardless of their demonstrated adequacy.

Faced with a specific problem, the applied psychologist must use some technique, and when proven techniques are unavailable, it is hardly surprising that he chooses one compatible with his own biases. Having done so, he is very likely to develop increased confidence in the technique simply because he uses it with apparent success in his day-to-day work. Lack of time and the circumstances of practical work rarely permit careful and rigorous validity checks, and it is easy to remember one's successes while forgetting one's failures. The result is that at present the preferred and most widely used techniques of personnel selection and clinical diagnosis are techniques chosen primarily on the basis of user confidence—"faith validity"—rather than demonstrated validity. Perhaps the best example is the use of the interview in personnel

selection. In spite of many studies showing almost no predictive validity of interview judgments with respect to future performance of applicants, it continues to be the most widely used technique in personnel selection both in industry and in educational institutions (Kelly, 1953).

WHAT IS UNDERSTANDING?

Anything more than an emotional consideration of the merits of the clinical and statistical approaches to the understanding of behavior requires making a clear distinction between two very different meanings of "understanding." Failure to make this distinction can lead only to needless confusion and unprofitable argument.

"Understanding A." To many persons, including some psychologists, understanding is an entirely personal experience in which the individual arrives at what *for him* is a logical (satisfying) explanation of a series of related events or phenomena which he has observed. That which the person feels he understands may be broad phenomena such as the meaning of death, the promulgation of light, the etiology of a disease, or the cause of human strife. Or the feeling of understanding may refer to a specific event: the death of a friend, the divorce of a husband and wife, or the suicide of a relative. In either instance, the essential requirement for *Understanding A* is that the explanation be satisfying to the person who experiences it. Even though at first purely personal, such an explanation may be an extremely perceptive hypothesis which, after later testing, will become a widely accepted principle in science. Unfortunately the explanation may also be completely bizarre, as in the case of a paranoid delusion, satisfying only the distorted logic of the person who experiences it.

"Understanding B." In science, understanding refers not to the personal experience of satisfaction with an explanation but to the development of general principles or laws which are so demonstrably correct as to be acceptable to the majority of one's fellow scientists. Scientific explanations need not and frequently do not lead to the personal experience of understanding discussed above. Instead, the correctness or appropriateness of the explanation is decided on the basis of the accuracy with which the principle (or equa-

tion) *predicts* the phenomena it purports to explain. No matter how logical or satisfying an explanation may be to an individual scientist, it will not be accepted by his fellow scientists unless it can be shown to meet the acid test of predicting future events of the same class.

As scientists, psychologists are obviously concerned with arriving at understanding of the kind designated *Understanding B* above. And in the long run applied psychology will contribute to the solution of human problems only to the degree that its laws and principles predict behavior. But since psychologists are asked to assist in solving many problems for which their science has not yet developed the basic laws and knowledge necessary for the development of highly effective techniques, applied psychology today is something of an art as well as an applied science.

Thus, for example, Psychologist A is employed by an industry to assist not only in personnel selection but "to develop improved efficiency and morale of employees." Psychologist B is a member of the staff of a mental hospital with responsibilities for assisting in the diagnosis of patients and in predicting the degree to which patients are likely to respond to alternative forms of treatment. Psychologist C, working in a university counseling center, and Psychologist D, in private practice, are confronted by individuals with personal problems. In all these examples the psychologist as a *practitioner* is forced to choose what, on the basis of his own experience and wisdom (*Understanding A*), are the most appropriate psychological principles and techniques for the problem at hand. Not even the university teacher of psychology can avoid such personalized judgments. In choosing his teaching methods, he implicitly assumes without adequate evidence that one method is (for him at least!) superior to others.

Since they are also human beings, applied psychologists, confronted with the necessity of making a choice in a problem situation to which there is no one correct answer, are not exempt from any of the several forms of defense mechanisms discussed in Chapter 7. Hence it is not surprising that each, in adopting an overall point of view and a particular set of techniques which are relatively satisfying to him in his day-to-day work, will be able to rationalize his own behavior. Such

defensiveness has only been increased by the accumulating evidence that many of the functions of psychologists in such applied settings can be carried out as well or better and at less expense by mechanical or clerical applications of psychological techniques by relatively untrained persons (Meehl, 1955). As can be imagined, such evidence is extremely threatening to proponents of the clinical method.

BOTH APPROACHES ARE NEEDED

In a large measure, the controversy is an unfortunate one; the entire history of science indicates that both clinical and statistical approaches are necessary in the development of any science and also in its applications. Creative and perceptive hypotheses which lead to scientific advances often emerge when a practitioner is confronted with a real problem; they first emerge as an *Understanding A*. Such hunches, however, contribute to the developing science only when rigorously tested and confirmed or refuted by experimental and/or statistical methods. Once confirmed as laws, they may contribute to the development of powerful techniques for application, frequently supplanting less reliable clinical methods which had earlier been widely used.

The application of science to practical problems is not automatic, however; another group of persons (practitioners, engineers, clinicians) must continue to diagnose problems and select appropriate techniques for their solution. These are "clinical" judgments, and they require a breadth of knowledge and experience typical of the professional person in our society. The good practitioner is one who on the basis of training and experience chooses the most appropriate and dependable techniques which his basic science provides while restricting the use of *Understanding A* to those aspects of the problem for which science has not yet provided the relevant knowledge or precise technique.

Because of the extreme complexity of its subject matter and the relatively undeveloped state of the science, the practice of psychology today admittedly relies heavily on the use of *Understanding A*. Only as psychology develops more effective techniques for use by the practitioner in his day-to-day work will the practice of psychology become

less of an art and more of an applied science. For such developments to occur, psychology crucially needs the kinds of observations and the sorts of creative hypotheses which the sensitive clinician is stimulated to make when confronted with real-life problems. As psychologists, however, we are well aware that not all hunches so derived are good ones. Every hunch must be tested by experimental

and/or statistical procedures before it can be regarded as contributing to any real understanding of human behavior. And regardless of how rapidly or how far the science of psychology develops, good practitioners will always be needed to decide which of its principles and techniques are peculiarly appropriate in the solution of a specific problem involving human behavior.

THE STRUCTURE OF INTELLECT, TEMPERAMENT, AND PERSONALITY

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Few areas of psychology have made such great strides in the last few years as that concerned with delineating the structure of abilities and temperament traits and the dynamic organization of personality. The findings here, in turn, have profoundly affected many other areas of psychology and have helped to make possible an increased certainty of prediction in education, industrial psychology, and clinical work.

One of the most valuable tools in this effort has been the technique of factor analysis, described on pages 73-74. A *factor*, or functional unity, is recognized by the fact that its parts consistently "go together"—where one appears, the others appear also. For example, the clinician speaks of something called "ego strength," manifested by (1) less than average emotionality, (2) better control of impulses, (3) more ability to tolerate frustration and stress, (4) greater realism in planning, and (5) less use of ego defense mechanisms. If a functional unity of this kind really exists, then low emotionality, high frustration tolerance, and the other behavior manifestations just mentioned should be found together consistently. At the same time, this group of expressions should be *independent* of other clusters, such as those involved in general intelligence or extraversion.

Until he actually engages in research, the student need not know how factor analysis is carried out, but he should understand the *logic* of the method, if he is to reason about personality structure. He should beware of the old danger of thinking that words like

memory or *anxiety* necessarily represent functionally unitary traits. He should also distinguish between a "correlation cluster" and a "factor." An observed cluster (like the five subtraits in ego strength) *generally* indicates the existence of a single factor, but *sometimes* a cluster is the result of two or more true factors operating together. Thus a cluster may be complex, but a factor is, logically, an experimentally demonstrated, unitary influence underlying an observed covariation of behavior.

The attempt to discover a limited number of underlying influences is not new in the history of psychology. The novelty in factor analysis lies in its substitution of exact record and calculation for the fallible human judgment of clinical attempts to find meaningful abstractions. Its importance lies in giving us accurate measurements and clearer, more realistic concepts about the way personality and abilities are organized. Application of this technique in the last decade, greatly facilitated by the advent of the electronic computer, has consolidated our knowledge of aptitudes and abilities and brought radically new notions both of temperament dimensions and of dynamic personality structures.

ABILITIES AND APTITUDES

Recently a committee of twenty leading factor analysts including Thurstone, Gullford, Tucker, Carroll, Humphreys, and others evaluated a large number of published studies to see what factors could be considered experimentally confirmed, since even published

studies vary considerably in merit (French, 1953). Fifteen such aptitudes or ability factors were finally agreed upon as confirmed. They include factors identified as verbal, numerical, spatial, reasoning, rote memory, speed and accuracy of perception, a special form of manual dexterity, verbal fluency, and so on. Thus Thurstone's original primaries were confirmed, and a number of new, fringe factors were clarified (Thurstone, 1938). For example, there seems to be a second spatial ability factor—not one only—while performances in memorizing split into at least three well-defined factors.

Since it is sometimes objected that current ability tests, with "selective" answers instead of inventive ones, fail to call for much of the kind of ability needed in everyday life, Guilford's recent work on creative ability factors is particularly interesting. He and his co-workers have found good evidence for some twenty new factors. It is possible that some of these are really temperament factors, discussed below, "outcropping," as it were, in the expression of abilities. Certainly no exact line can be drawn between them.

Some students get the impression that there is a contradiction between Spearman's earlier demonstrations of a single "general intelligence" factor, on which the I.Q. is typically based, and Thurstone's later demonstration of a dozen or so "primary abilities." Actually the findings have now become integrated through the concepts of "first-order" and "second-order" factors. That is to say, there *are* distinct first-order factors, just as Thurstone found, but these are correlated among themselves and become grouped in a single second-order factor—Spearman's "general intelligence"—underlying them all. A finger is a unitary organ, but so also is the hand. This mode of thinking in terms of first-order and second-order unities is something we need to become familiar with in all our dealings with personality structure.

One of the currently unsolved problems about ability concerns the possible existence of two (or even more) forms of truly *general* ability—what must be called a "g" and a "g'" if we use Spearman's symbol. Many years ago Thorndike and Lorge showed that on all kinds of tests in a general intelligence battery, younger adults do better on speeded (time limit) tests while middle-aged people do just as well on power (handling complexity with-

out speed) tests (Thorndike *et al.*, 1926; Lorge, 1936). After studying this evidence, as well as data on brain injury and so on, Cattell and Hebb independently put forward a dual concept of intelligence, the two varieties being called by the first author "fluid" and "crystallized" intelligence factors (Cattell, 1941; Hebb, 1949). Fluid general ability is measured by speeded tests and by perceptual, culture-free tests. Brain injury lowers the ability as a whole, and it declines steadily after late adolescence. Crystallized general ability shows in tests involving verbal and other acquired skills, in power tests, in appearance of specific local losses through brain injury, and in absence of age decline. Though of interest clinically, this distinction has been little used in practical research, for throughout the school period fluid and crystallized ability "move together" and are generally measured by a single test.

PERSONALITY STRUCTURE

It was some years before the factor analytic methods, which had proved so successful in structuring abilities, were applied to personality, with equally definite results. Like all more recent findings, the patterns which have emerged, though definite, still need more extensive confirmation.

Factors were first found, separately, in ratings, self-inventories, and objective tests, but it was soon shown that the factors found through rating behavior were the same as those appearing in the "mental interiors" from self-inventories (questionnaires). Sixteen to twenty factors have now been confirmed three or more times on groups of young adults (Thurstone, 1934; Cattell, 1945, 1947, 1948a, 1948b; Eysenck, *et al.*, 1947; Cattell and Saunders, 1950; Kelly and Fiske, 1951; Cattell and Gruen, 1954). A few of the more important factors may be briefly designated as follows:

Cyclothymia versus Schizothymia ("A" Factor). This shows itself in carefree, emotionally expressive, outgoing behavior at the positive (cyclothyme) pole, and in rigid, aloof, cold attitudes at the negative pole. It is the chief factor involved in determining interest in jobs having to do with people. If a person suffers a mental breakdown, this factor also influences the direction of abnormal expression—manic-depressive or schizophrenic.

Ego Strength versus Neurotic Tendency ("C" Factor). This shows in emotional maturity, stability, and realism at the positive pole, and in general emotionality, dissatisfaction with life, many ego defense mechanisms, and neurotic symptoms at the negative pole. Scored in this negative direction it may be thought of as "degree of neuroticism."

Surgency versus Desurgency ("F" Factor). Ratings and questionnaire responses showing cheerful, carefree, talkative, happy-go-lucky ways of behaving appear positively loaded, while sober, dour, restrained attitudes characterize desurgency.

Premia versus Harria ("I" Factor). These terms have been developed to distinguish a factor suggested by William James in his notion of a "tender versus tough-minded" dimension. Premic individuals are sensitive, artistic, easily upset; harric individuals, tough, responsible, "no nonsense."

Radicalism versus Conservatism ("Q1" Factor). This factor was first found in attitudes, such as those on political and religious issues (Thurstone, 1944; Lentz, 1938), but recent work shows that it is really a general personality or temperament factor, causing the person to be consistently radical or conservative in most things that he does.

After factor analysis has revealed functional unities, it is, as a rule, possible to set up a test battery—at least in self-inventory form—and to score any person's level on the given dimension. Several years of research may still be necessary, however, to decide exactly what the dimension is. It may represent a temperamental or physiological difference, as in the Cyclothymia-Schizothymia dimension, where twin studies have shown a high degree of inateness; it may be the result of learning, as seems true of the pattern of Premia versus Harria; or it may represent the degree of achieved dynamic integration of the total personality, as in Ego Strength measurement.

The above factors, plus a dozen others, such as Dominance versus Submissiveness, Ergic Tension, Superego Strength, Self-Sufficiency, and Self-Sentiment Development, are measurable by questionnaires such as Cattell's *Sixteen Personality Factor Questionnaire*, the Guilford-Zimmerman scales, and Thurstone's *Temperament Schedule*. Until these factors are cross identified, however, they must remain under different names in the different scales.

Recently, there have been determined attempts to measure these factors in terms of *objective tests*. "Objective" is sometimes used in the sense that the same scores are guaranteed by different psychometrists for the same test performance, but in the present context it means that the subject is *not* doing a self-inventory test in which he evaluates *himself* but is actually performing in a "miniature situation" where someone else rates his responses. These new objective tests comprise "projective" (or, better, "misperceptive") items, like those in the T.A.T. and the Rorschach, and also a great variety of entirely novel tests. Some place the subject in actual, standardized situations to see what he will do; all measure *what the subject does*, not what he says he would do, as in self-inventories.

The four hundred varieties of objective tests so far tried cover a much wider range of behavior than the "projective tests" do; analysis of them has yielded eighteen independent factors, now embodied in the *Objective-Analytic Personality Test Battery* (Cattell, 1956). Already these factors have shown their value in predicting real-life behaviors, such as success in certain occupations, college achievement, and clinical condition.

As an example of the last, we may take the findings of a factor corresponding to neuroticism (Eysenck *et al.*, 1947; Cattell, 1947). Here a collection of objective tests which distinguish significantly between neurotics and normals (Eysenck *et al.*, 1947) can be shown to be measuring a single factor dimension. The following table gives the pattern of "loadings" on this neuroticism factor found in five independent studies with different groups (Cattell, 1957).

	Research Groups				
	1	2	3	4	5
high motor-perceptual rigidity	.29	.58	.20	.37	.42
poor two-hand coordination (Thurstone test)	.20	.20	.37	.36	.36
high body sway suggestibility	.13	.26	.12	.10	.64
high ratio of inaccuracy to speed	(-)	.20	.29	.36	.40

Other tests loaded in the neuroticism factor are low dynamic momentum (endurance in tasks), low fluency, low metabolic rate change

with stimulation, and preference for form over color in picture (Cattell, 1957).

Similar researches on large groups, inter-correlating a hundred or more objective tests, have shown a single major factor of anxiety, distinct from the neuroticism factor (Cattell, 1957). Anxiety, neuroticism, extraversion, or any one of the remaining factors in the Objective-Analytic Personality Test Battery can now be measured, therefore, by totalling the scores on about a dozen subtests—those most loaded in the factor—just as one gets an intelligence factor score from adding the intelligence subtest scores. However, much research remains to be done before the measures can be made both as brief and as reliable as present intelligence factor measurements. Moreover, although in some instances the nature of the factor is clearly recognizable, as in the case of neuroticism and extraversion, in other cases psychologists have yet to identify the concept underlying the factor pattern.

In these areas experimenters have still to try various possible interpretations of the factors by introducing crucial tests and finding how they correlate with the factor (Eysenck, 1953; Cattell, 1957). The important thing is that these factor patterns provide the psychologist with a more substantial basis for creating his hypotheses about personality structure than does unaided clinical observation or a mere armchair hunch.

Research on personality structure by factor analytic methods is not concerned merely with experimentally "taking personality apart," as into first-order and second-order factors. It aims also at (1) finding the relations among the factors, which are generally somewhat intercorrelated, (2) plotting their growth curves in the course of development, (3) assessing their interactions in producing a given kind of behavior, and (4) determining their origins in physiological influences or learning experiences. The uniqueness of a given personality can always be expressed as a *unique combination of scores on common factors*, as in a psychograph or profile (see page 82). What a person will do in any given performance can then be predicted (or estimated) by applying the experimentally discovered loadings for factors in that performance to his particular profile values. For example, success in leadership has been shown (Cattell and Stice, 1954) to be predictable roughly, as shown in this *specification equation*:

$$\text{leadership success} = .3F_C + .5F_F + .4F_G - .4F_O \text{ etc.}$$

This formula says that to estimate his probable leadership success we multiply the person's score on C (Ego Strength, above) by .3 and his F (Surgeency), G (Super-Ego), and O (Depressive Anxiety) scores by .5 and .4 and .4, respectively; then add the first three figures, subtract the fourth; and so on. Skill as a psychiatric technician, on the other hand, requires quite a different weighting of these and other factors. Research is making rapid strides in discovering these weightings for various occupational and clinical outcomes.

MOTIVATIONAL FACTORS

Important as the above developments are, they are eclipsed at the moment by the significance of recent findings from applying factor analysis to a wide range of measures of *motivation* strength in attitudes and interests. Early success in structuring such fragile and complex behavior manifestations was scarcely to be expected; yet four successive researches (Guilford *et al.*, 1953, 1954; Torr, 1953; Cattell, 1957; Cattell and Haggaley, 1958) have shown good agreement in indicating unitary sources of interest. The factors in motive appear to be of two kinds: (1) patterns covering single areas of acquired interests, such as athletic interests, religion, career, etc., and perhaps best designated *sentiments*, because they clearly represent learned organizations of attitudes, and (2) patterns in which all the loaded attitudes are found both to have a certain common emotional quality and to share a specific biological goal such as, for example, sex, fear, gregariousness, and parental-protective behavior.

These factorings of interest responses are of great theoretical interest because they give the first real experimental proof of the number and nature of *drives* in man. While clinical psychology, especially, could not get on *without* "instincts" or "propensities," experimental psychology, in the past twenty years, could not get on *with* them—it could find no clear evidence for them. Propensities have thus long remained scientifically unproven. This new approach, revealing drive patterns, does not say that the attitudes and ways of behaving that constitute a drive factor are innate but only that the dynamic *unities* exist and are probably innate because those isolated so closely resemble the instinct patterns of primates and higher mammals. That is, there must be some quality about the tension of,

say, the fear drive, which makes it independent of the tension level in any other drive, such as sex or self-assertion. To avoid the unwanted implications of such popular terms as *drive* or *propensity*, and the historical vendettas associated therewith, it has been suggested that the term *erg* (rhymes with *berg*) be applied to these structures, and that the expression *ergic tension* refer to the strength of the "need" in any erg at a given time.

Present findings suggest the existence of about eight or nine ergic patterns: sex, narcissistic sex, self-assertion, fear, curiosity, gregariousness, parental protectiveness (succorance), and perhaps rest-seeking (sleep) and appeal (despair). The student should compare these with the lists proposed more arbitrarily and less experimentally by Freud, McDougall, Murray, Edwards, and others (Freud, 1920; McDougall, 1934; Murray, 1938; Edwards, 1954).

In the experimental work here described the actual measurements of specific attitudes in individual persons have been carried out by *objective* motivation strength tests, which include performances similar to those on the

T.A.T. and also devices from physiology, learning theory, and defense mechanisms. These objective devices have proved to be more valid measures of motivation strength than devices previously used, like opinionnaires (Cattell *et al.*, 1949; Cattell, 1957). This validation of motivation tests and the more definite knowledge about the number of drives and their boundaries make possible the construction of test batteries to measure the tension level of particular ergs. And the provision of batteries, in turn, makes it possible at last to investigate experimentally a number of important theoretical issues, such as what internal physiological states are related to drive tension, what stimuli in our culture typically provoke particular drives, how measures of the strength and frustration of drives can help clinical diagnostic practice, and into what specific drive sources any given symptoms can be objectively analyzed. Thus the structuring of personality and motivation is indeed a rapidly advancing frontier of psychology and one which the student must explore as a basis for work in many other areas of psychology.

HUMAN MOTIVATION

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If one observes the human infant throughout a day's time, one notes that there are periods in which he becomes restless, whimpers, and may close his eyes and cry. Psychologists describe these behaviors as the results of the hunger drive because the behavior pattern changes very markedly if the infant is fed. He sucks on his bottle, and after he has been successfully burped, he falls asleep.

No one questions the motivating power of the hunger drive, but it may be noted that even the neonate is hungry a very limited portion of his waking hours. His hunger complaints call forth food-providing behavior by the parent, and more frequently than not, his hunger needs become anticipated by the parent before they even arise. Hunger, like most primary drives, is unpleasant, and for countless millenia the human animal has done everything in his power to prevent it, for himself and for his infants. So even though only a small fraction of the neonate's life is dominated by hunger, or by any other primary

drive, the percentage steadily decreases with the passage of time, partly because the child's waking time increases and partly because of better anticipatory control of hunger and other biological drives.

If the biological drives were the primary motivating mechanisms of the human being, 95 per cent or more of our lives would be spent in unconstructive activities, or, more realistically, the human race would not have survived and been permitted the luxury of "driveless" living most of the time. But if one observes the human infant closely, it becomes apparent that his waking hours are constantly being spent in useful toil, within the limits of his motor and sensory capacities. At a few days of age he starts visual scanning of his environment, and this process continues vigorously, for the human being is motivated to investigate with his eyes, not because of hunger or any other primary drive but because, like virtue, the act of visual investigation is its own reward. Less obviously, the human

infant is also searching by sound cues to obtain information concerning his world, and this search for sound early in life supplies him with a rich source of guiding and informational cues.

Even more important for the neonate than visual or auditory exploration is the preeminently important search for contact. The neonate is constantly searching with his hands, and actually with his entire body, for contact experience of appropriate kinds. This motivation to obtain appropriate contact remains a neglected area of scientific research; the importance of this need and the ways in which it influences human behavior are only now becoming recognized and being subjected to experimental investigation.

Although careful observation makes it clear that the various exploratory motives are of vast importance to the human being, it is very difficult to subject these motives to experimental investigation with the human infant as the subject. The motor mechanisms in the human child mature so slowly that it is extremely difficult to measure accurately all his capabilities. Six months or more must elapse before he can use his hands with any real degree of precision, nine or ten months pass before he can maintain posture efficiently, and more than a year elapses before he can maintain the upright locomotor pattern characterizing the human species. Fortunately, there are other animals very similar to man both in structure and developmental trends which attain normal posture and normal manipulatory abilities at or near birth. These are the monkeys, man's closest phylogenetic relatives except for the great apes. We can be virtually certain that these animals will have the same motivational patterns

that characterize man, or at least highly similar ones, and we have every reason to believe that the motivational laws which can be discovered by experiments on neonatal and baby monkeys will be applicable to neonatal and baby human beings.

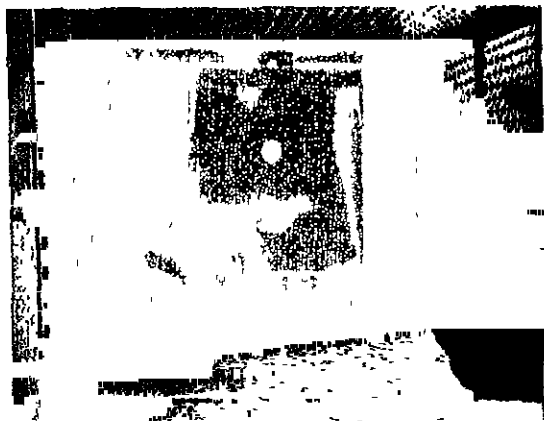
On the basis of these principles, a major research program has been initiated at the University of Wisconsin for tracing the development of the various motivational systems in the rhesus monkey. The subjects were removed from their mothers a few hours after birth and reared by laboratory personnel using techniques very similar to those employed with bottle-fed human babies. The method of hand-rearing and bottle-feeding proved very successful, and almost all the infant monkeys flourished; indeed, they consistently weighed more than monkeys allowed to stay with their own mothers. Only three of more than sixty monkeys raised in this manner developed any serious illness.

The rhesus monkey can usually maintain normal posture at birth and walk effectively at about five days of age. Adequate manipulatory capabilities are present at birth, and all the basic sensory mechanisms are apparently functional at this time.

During the first day or two of life the monkey evidences visual curiosity and exploration. The neonates orient to moving objects placed outside the living cage, particularly if the objects are illuminated; they toddle across the cage toward them, try to reach through the cage and grasp them, and, failing in this, stare fixedly at the objects for minutes or even hours at a time. This visual curiosity is unquestionably innate, even though the monkeys lack ability to discriminate visual detail at this time.

From the feeding technique developed for the newborn monkeys, additional information was gained about motivation. The apparatus illustrated at left consists of a cloth-covered wire ramp which leads to the nursing bottle. The neonatal monkey climbs up the ramp, mouths the nipple, and sucks. It is very important that the ramp be covered with cloth if maximally efficient nursing is to take place, because the very act of sucking appears to be in part dependent upon the simultaneous satisfaction of a need for the comfort of contact.

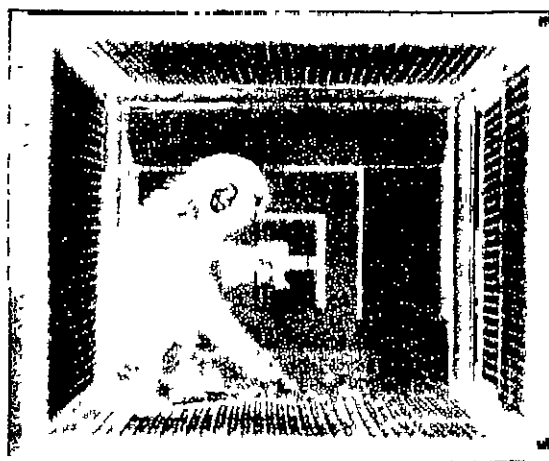
In the cage of every infant there is placed a large, folded piece of cheesecloth, and the monkey clings to and cherishes this from the first day of life onward. The baby monkeys



are very strongly motivated to clasp and hold this cheesecloth just as the babies in the wild are strongly motivated to clasp and contact their mothers' bodies. When the cloth is removed for laundering each day, the babies vocally complain and have temper tantrums. Human parents see this need for contact comfort operating in their children: youngsters become devoted to their blankets, their pillows, and their furry teddy bears. These attachments are not in any way abnormal; they are, instead, the satisfaction of one of the most basic and important motives existing within the primate order and, undoubtedly, in all mammals, in many other orders, and in other phyla.

Before the tenth day the monkey climbs up the ramp and then moves his head back and forth until his cheek contacts the nipple of the nursing bottle. The sensory cue to nursing is always contact, not vision. Between the tenth and twelfth day, however, this suddenly changes. From this time on the cue becomes visual: the baby looks, sees the nipple, and mouths it. At this very same time the monkey suddenly develops the ability to learn discrimination problems, such as have been described on page 305. Very rapidly he develops the ability to discriminate between black and white horizontal versus vertical bars and between triangles and circles. It is obvious that the capacity to respond to visual detail, as contrasted with a more primitive type of vision, has evolved, doubtless through some maturational process.

At this time the monkey begins to show a compulsive need for visual exploration, which leads to manipulation. He can see and he must see; he can manipulate and he cannot keep himself from manipulating. He searches his cage for anything to explore: some mechanical part of the cage or any toy or plaything that is introduced. This is a strong, powerful, compulsive motive. If the best plaything available is only a piece of chain hanging down into the cage, he will bat it back and forth or pull it dozens or hundreds of times a day. If a more intriguing plaything, such as a mechanical puzzle, is placed in the cage, he will work on it again and again as shown in the picture above and will, after a time, learn how to solve it for no other reward than the sheer satisfaction of making the proper movements. Once the motives of visual exploration, curiosity, and subsequent manipulation appear, they are never lost, and mon-



keys both in their cages and in the wild spend a large part of their day engaging in these activities.

It may be noted that the curiosity motive precedes the motivation to eat solid food—in fact, learning to eat solid food is dependent upon curiosity and manipulation. When infant monkeys are first given bits of solid food, they treat them as they would any other toys. They pick up these “toys,” play with them, throw them about, put them in their mouth, and manipulate them with their lips and teeth. Even after it looks as though food is being swallowed, objective tests indicate that many days may pass before a single piece of food is consumed or even partially eaten. The monkey does not explore to obtain solid food; he obtains solid food by exploring!

The development in baby monkeys of the exploratory-manipulatory motives has a close parallel in the development of these same needs in human children. Even before three months of age the baby in his crib is frequently exploring and manipulating. As soon as the baby can creep, and even more when he can walk, he is “all over the house” and “into everything.” He takes the silverware out of the drawer and hides it under the sofa cushions. He takes all the items out of dresser drawers and rearranges them in the center of the floor to suit his tastes. At the dinner table he throws his peas on the floor, pours his milk on his potatoes, puts both hands in the center of his plate and then fingerpaints on the tablecloth. Some psychologists call this the hunger drive, but even in the infant, the hunger to see and do may be much stronger than the hunger to eat.

Actually, the curiosity and manipulatory motives appear to be stronger in human children than in monkey children and much broader in range and scope. The monkey will play with the same puzzle almost endlessly day in and day out, but the child tires of any individual plaything and restlessly investigates and manipulates one object after another. There is another difference: the monkey always takes things apart and never puts them together, whereas the child takes things apart and frequently tries to reassemble them. Bright children exhibit much stronger exploration-manipulation motives than dull children.

Even very young children show strong affection for their parents, particularly their mothers. What is the basis of this filial love? Recently experiments have been begun at the University of Wisconsin to determine the conditions that produce love-of-mother in infant monkeys. An artificial mother, or pseudomother, as shown on page 526, was constructed. The body was made of a block of wood overlaid with sponge rubber, which, in turn, was covered by a terry cloth skin. The pseudomother body was then mounted on a sponge rubber base, and a wooden head was attached to the top of the torso.

Even though these pseudomothers cannot caress their infants, the baby monkeys rapidly develop a strong affection for them. Half of the pseudomothers do not feed their infants, but this is a variable of either little or no importance. The infants love their pseudomothers whether fed by them or not. The babies sleep on their pseudomothers, clutch and cuddle them, and explore and manipulate them after the appropriate, critical maturational day has been reached. In many ways the pseudomothers are very good mothers. They never reject or punish their children, they look after them twenty-four hours a day, and they provide them with contact comfort, which appears to be the

variable of primary importance for the development of neonatal love. Contact comfort is probably the first motive to appear, and it is of vast importance to normal development. It is as primary and as important as any biological drive.

The infants demonstrate love-of-mother in many ways. If frightened, they rush wildly to their pseudomothers and clutch them tightly. They behave exactly as infant monkeys reared with real mothers behave toward their mothers. If their pseudomothers are taken away, the infants cry and scream, shudder and jerk convulsively, twist, squirm, and roll over on their backs. When the mothers are returned, they rush to them, cling to them, and utter the soft little sounds which indicate monkey happiness.

How long does the love for the pseudomother last? Here we do not know the complete story, but it lasts at least for weeks and months and probably for years. Do the infant monkeys transfer this love-of-mother to real-life monkeys? Yes, they adjust to other monkey children, even though they may love their pseudomother best and seek her comfort and protection when they are frightened or disturbed. It was surprising to discover that contact comfort is apparently the primary motive for the development of neonatal love. Doubtless out of this develop all personal affectional experiences.

For many years psychologists have discoursed at length about the importance of the biological drives, and some psychologists and sociologists have speculated that all human motivation was dependent on, and derived from, these motives. We now know that this is not true. The biological drives are important, particularly in protecting the organism under conditions of deprivation and desperation. But these are not the motives upon which the rich and warm life, the positive goal-seeking life of either monkeys or men depends.

LEARNING THEORY, PSYCHOANALYSIS, AND COMMON SENSE

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If we now look back and appraise the field of psychology during the first half of this century, it is fair to say that learning theory

and psychoanalysis have been the two most influential and seminal developments. But it is also now apparent that neither of these two

conceptual systems has been entirely satisfactory. McClelland puts it thus:

"[His work on psychoanalysis] involved Freud in problems of memory for content and of perception, problems which Hull failed to deal with satisfactorily in his system. To the extent that Hull neglected dream life, Freud neglected the psychology of learning. If one may presume to stand in judgment, we might conclude that to the extent that both of them tried hard to build general systems of psychology, each began with too narrow a base" (McClelland, 1957).

Outstanding among numerous attempts to devise a more inclusive, more adequate psychology by "combining" Hull's learning theory and Freudian psychoanalysis is the work of Miller and Dollard (Miller and Dollard, 1941; Dollard and Miller, 1950). But these two systems of thought are continuing to evolve, develop, and change, so that attempts to unite and unify them, in their original form, have been somewhat premature. Our first purpose here will be to note the ongoing trends which have resulted in neo-Hullian learning theory and in neo-Freudian psychoanalysis. Then we shall consider the possibility of a new synthesis and its agreement with common sense.

The two great tributaries which flowed into and produced Hull's system were the researches of Thorndike and of Pavlov. As is well known, Thorndike based his psychology of learning upon the notion that reward makes "habits" and that punishment unmakes them and that a habit consists of a functional "bond" or "connection" in the nervous system between stimulation and response. Thorndike was thus a thoroughgoing "connectionist" and saw no need for the concept of consciousness in his formal scheme. Hull accepted what may be called the "positive half" of Thorndike's system, namely the assumption that habits are "stamped in" by reward, and then went on to incorporate Pavlov's observation that reward can do something else—namely, cause an external, independent stimulus (signal) with which it has been associated to take on special interest and attraction ("positive cathexis," in Freud's language) for the subject. Thus could one explain how it is that an organism learns not only to *do* certain things—*response* learning—but also to *seek* or approach certain stimuli—*place* learning (cf. Tolman and Gleitman, 1949).

But Hull's system was manifestly incomplete in that it took little or no notice of the fact of punishment (response avoidance) and of learning wherein an organism comes to fear and shun certain stimuli (place avoidance). Thus, while Hull was developing and unifying selected elements in Thorndike's and Pavlov's systems, several other works were centering their interest on the neglected elements in these two systems, notably the effects of punishment on a particular response and on an organism's behavior toward specific, external stimuli (Miller and Dollard, 1941; Mowrer, 1950).

Thorndike had assumed that a punishment (sudden and painful increase in stimulation) had the effect of directly weakening the connection that supposedly mediated a habit. But the works just cited suggested a different notion. Numerous experiments indicate that if "punishment" follows a stimulus (signal) presented by the experimenter, the first thing the subject learns is to *be afraid* when that stimulus occurs. Then, as an ensuing development, the subject learns what to *do* as a means of getting rid of or avoiding this stimulus—and the fear which it arouses. It was therefore natural enough for a new theory of response avoidance (inhibition) to emerge. This theory suggests that as the so-called punished response occurs, inner stimuli are being aroused (in the muscles, for example) and that punishment, instead of acting as Thorndike supposed, causes fear to become conditioned to these response-correlated stimuli; then the next time the subject starts to make this response, the accompanying stimulation elicits fear—"reminds" him of the former punishment—and thus sets up a competing form of motivation. Not only did this view fit with common experience, but it also opened up the possibility, which had not previously existed, for an articulation between the psychology of *conflict* (an important feature of psychoanalysis) and the psychology of learning.

But, more important still, this altered view of response inhibition suggested a new way of thinking about habit formation itself. Long ago Pavlov and his students showed that if an external stimulus is associated with reward (reduction in drive or motivation), that stimulus becomes interesting and attractive so that the subject will strive to *get more* of it (cf. the concept of *adience*, Holt, 1931). Now might it not be that a so-called habit con-

sists simply of an effort on the part of an organism to get more of those stimuli (muscular, etc.) which are aroused when a previously rewarded response starts to occur (or perhaps is even just thought about)? Thus, just as fear tends to inhibit a response which has been punished, so would *hope* (or secondary reinforcement) facilitate the recurrence of a response which has previously been rewarded. Such a view is consistent with the fact (noted by Thorndike and in common experience) that rewards do increase and that punishments do decrease the likelihood that a particular response will occur; but it departs from Thorndike (and Hull) by making both habit formation and habit inhibition dependent upon favorable or unfavorable *feedback* from response-correlated stimuli, rather than upon stamping-in or stamping-out of "bonds."

According to the new formulation, all learning is thus reduced to sign learning or conditioning, falling neatly into four classes: the conditioning of fear to (1) external, independent stimuli (place avoidance) or to (2) response-correlated stimuli (response avoidance) and the conditioning of hope to (3) external, independent stimuli (place approach) or to (4) response-correlated stimuli (response facilitation) (Mowrer, 1956). Numerous technical dilemmas are resolved by this formulation; but, what is equally important, it restores a relationship between learning theory and the manifest fact of consciousness (Collier, 1956). The theories of Thorndike, Pavlov, and Hull were essentially reflexological (behavioristic). The position just sketched presupposes reflexology only to the extent of the conditioning of hope and fear; actual behavior, it assumes, is controlled by the intricate computer (decision-making) system which we call consciousness.

Such a conception of learning articulates readily with contemporary servo-theory (cybernetics) and certain forms of "field theory." Also it provides a satisfactory basis for a psychology of language, although here it must be extended to include the additional notion that *sensations* (in the form of images) as well as motives can be conditioned, in order to provide the basis for memory and other mediating processes (Mowrer, 1954).

Turning now to the corresponding developments which have been occurring in psycho-

analytic thought, we find that outstanding here is the shift in emphasis from *interpretation* to *integration*. Originally it was largely taken for granted that if the unconscious could be made conscious (by means of the patient's own free associations and the analyst's interpretative comments), mental health would ensue automatically (Freud, 1928). But gradually it has become evident that such an assumption is unwarranted; more and more, workers in the field have begun to emphasize what they call "ego psychology" (Ausubel, 1952). Increasingly, it is now being assumed that psychopathology occurs not because the superego is "too severe" (as Freud supposed) but rather because of ego weakness. Granted that ego, superego, and id are abstractions made for the sake of system building, the distinction just drawn is nevertheless meaningful at a common-sense level and may very well be valid in a scientific sense.

The development just described has precipitated something of a crisis for psychoanalysis. As long as the principal therapeutic goal of analysis was to "make the unconscious conscious," the Freudian rationale was satisfactory and sufficient. The roles of interpretation, transference, countertransference, and the like were clear. But with the new emphasis upon what may be called ego therapy, workers in the field find themselves without chart or compass, as evidenced by the remark that "Psychotherapy is today in a state of disarray, almost exactly as it was two hundred years ago" (Zilboorg, 1956).

According to the classical Freudian position, the individual patient was reactive but not responsible, and the whole effort in therapy was to do something *to* and *for* him, in the form of treatment, which would make him happier and more comfortable. Now, with the new emphasis upon ego psychology, there is a growing interest in the concept of responsibility, ego weakness being roughly equated to irresponsibility and ego strength to responsibility. But the main body of psychoanalytic theory has little to say as to how an individual may move from weakness to strength. Religion and ethical theory, by contrast, have long been concerned with precisely this problem, and there are now many indications that a rapprochement between secular and spiritual healing is in the making.

This will not be easy, since Freud was convinced of the uselessness and even irrationality of religion (Freud, 1928), but already considerable reconciliation has occurred (Fromm-Reichmann and Moreno, 1956). In the following paragraphs an approach to further synthesis will be suggested.

Clergymen have been urged both by their own training institutions and by psychiatrists and psychologists to feel that religion is not prepared to deal with "unconscious processes." But one wonders if this position is necessarily valid. Here we may take our cue from a comment made by Harry Emerson Fosdick.

"Things act under the influence of stimuli; they may even be said to react to stimuli, but persons can respond. Reaction is mechanical, while response is personal, and the endeavors of materialists to reduce the latter to the former are unconvincing because in actual experience the two are so radically different. Billiard balls react; persons can do more. A sneeze is a reaction, but the triumphant answers which some personalities make to life's difficult situations cannot be convincingly subsumed under such a category. Socrates' reply to his judges was not a sneeze, but a response" (Fosdick, 1943).

Slightly restated, this passage seems to be saying that a *real* person—a person with good character and strong ego (but not "egotistical")—deals with his life experiences and situations responsibly, thoughtfully, ethically, concernedly; in short, he "uses his head." A neurotic individual is impulsive, acts under compulsion, feels driven and constrained—in short, he "loses his head."

The whole force of religion, it would seem, is directed at this problem of getting the individual to "be good" (responsible), to be guided by choice rather than by compulsion. And certainly choice is a more conscious phenomenon than is inner compulsion. Hence, it may be said that religion is quite specifically concerned with "making the unconscious conscious." And to the extent that various forms of neo-Freudian psychoanalysis now try to strengthen the ego (rather than weaken the superego), it is clear that there is considerable basis for agreement between religion and psychoanalysis.

Finally, we come to the question of how all this relates to the newer trends in the

psychology of learning. If our earlier analysis is correct the notion that behavior is essentially reflexive (mediated by bonds) is giving way to the view that it is much more complexly determined (by a system or process known as consciousness); and the reason, both theoretically and practically, for the ascendancy of consciously mediated behavior over reflexes is that the former is so much more flexible, adaptive, and "intelligent" (Collier, 1956). As we have seen, certain "reflexes" (conditioned reflexes) are still assumed to be involved in the instigation and conscious control of action, notably those of hope and fear; but these are emotions, not motions, and as long as they are, so to say, processed and evaluated and judged consciously, behavior remains flexible, free, intelligent. When, however, fear is directly connected (conditioned) to certain drives or needs (rather than to the stimuli which certain behaviors produce), then consciousness is by-passed and control reverts from the conscious level to the automatic, unconscious level.

When is such a regression or reversion likely to occur? This question is not easy to answer, at least not briefly. Suffice it to say that control reverts from the conscious (voluntary) to the unconscious (neurotic, compulsive) level when the ego has rejected an integrative task or has otherwise proven incompetent or irresponsible. Thus, once again, we see why, both in psychotherapy and in common practice, there is a tendency to urge individuals to "be responsible." In religious terms, such a way of behaving leads to the "more abundant life," whereas the "wages of sin (irresponsibility) is death." Thus, says Fosdick, "There is an understandable reason . . . why in modern psychological parlance the word 'integration' has taken the place of the religious word 'salvation'" (Fosdick, 1943). Psychologically they appear to mean much the same thing.

The new (also very old) conception of personality and personality disorder here delineated is still in the process of development and consolidation. The present abbreviated discussion should, however, at least indicate the *direction* in which contemporary thought and practice are moving. In general, it seems a good direction, one that shows signs of high promise.

THE DEVELOPMENT OF A SCIENTIFIC PSYCHOLOGY OF LEARNING

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To the beginning student, one of the most puzzling aspects of psychology is the very great extent to which the material presented and discussed differs from his expectations. Even if he has previously had courses in other sciences, he is frequently perplexed by the extent to which the psychologist seems to ignore the familiar, everyday behavior of humans and deals instead with what appear to be highly oversimplified kinds of behavior under very artificial conditions. Somehow the student (indeed the layman in general) is not quite prepared for the artificiality of the psychological laboratory, even though he may have a good appreciation of the necessity for, and extensive use of, such conditions in the physical sciences.

In some instances this state of affairs is undoubtedly the result of a failure to understand (or accept) the view that psychology is a natural science, attempting to discover the same kind of abstract, lawful knowledge as other physical and biological sciences; but even when such is not the case, the student is nevertheless often surprised. In those latter instances the explanation may be that the student has already had considerably more first-hand acquaintance with what the psychologist professes to study—namely, the behavior of himself and of others—than he has had with the things that the physicist, chemist, or physiologist attempts to investigate. As a consequence of this greater experience, the student probably has more definite expectations as to what psychology is or should be about than in the case of other sciences and hence greater surprise and puzzlement over what he later discovers it to be.

One of the most striking instances of this discrepancy between the student's expectations and the psychologist's treatment is in the field of learning, an area of knowledge with which the student rightly feels he is highly familiar, as the result of his own experience. Indeed it is readily apparent that every one of us has been a subject, as it were, in innumerable naturalistic experiments in which new kinds of behavior were learned,

and we have had many opportunities to observe other people learning. But instead of these familiar instances of learning, the psychologist's treatment emphasizes such strange things as the conditioning of the salivary response in dogs or the simple eyelid blink in humans, the acquisition of a lever-pressing habit by the white rat, and the learning of paired associates by human subjects using a machine that presents them at a rate to preclude any possible rehearsal such as would likely occur in the learning of this kind of material in real life.

Why does the psychologist apparently choose to ignore the familiar examples of learning in real-life situations and instead substitute the artificial, unlife-like situations that he does? The fact of the matter is that the observation of learning in real-life situations has not been of much help to the learning psychologist. At most, such observations have served to acquaint him with the fact that behavior does change profoundly with practice or experience and, upon analysis, to suggest some of the factors or variables that possibly affect such learning. However, neither nature nor society provides the kinds of simplified conditions—and particularly the necessary regularities among them—that are required for the discovery of the quantitative laws that the scientist seeks. The attainment of this type of knowledge requires the development and use of precise methods of measuring the behavior being studied and also the control and systematic variation of the relevant environmental and organic variables.

The so-called classical conditioning experiment, involving the conditioning of the salivary response in the dog, provides a particularly good example of such a precisely controlled observational situation. All irrelevant stimulation external to the animal subject is kept constant, and variations in internal stimulation are minimized by training the dog beforehand to remain fixed and quiet in the apparatus. The unconditioned response, salivation, that is to become associated with a new stimulus is under strict

control of the experimenter, being elicited by the introduction into the environment of the so-called *unconditioned stimulus*, food. Also determining, as he does, the onset of the *conditioned stimulus* (the sound of a bell, for example), the experimenter is thus able to control—either maintain constant or vary systematically—the temporal relation between the sensory event produced by the bell and the response event produced by the food. Precise measurement of both stimulus conditions and variations in the magnitude of the conditioned response are also possible.

Employing a variety of similar kinds of classical conditioning situations and also simple laboratory arrangements known as instrumental conditioning, the learning psychologist has been able to discover and formulate in fairly precise fashion a large number of empirical, quantitative laws relating various response measures to the relevant environmental and organic variables. Furthermore, out of this empirical work theoretical schemes or networks of abstract concepts have begun to develop which, in combination with the experimental variables and boundary conditions, provide for the deduction (and hence explanation) of the many specific, empirical functions that have been found in these simple types of learning situations.

But what good or possible use, one may ask, are such precise quantitative laws and successful theoretical integrations when they are concerned with behavior that is so much simpler and more artificial than the complex learned behavior exhibited by humans in real life? Such a question is to be expected from the student just becoming acquainted with a science for the first time. The answer, in so far as it can be given in the brief space available, is that the development of a scientific body of knowledge with its characteristic theoretical integration always involves such experimental analysis of complex events into simpler events.

A particularly good example from another field of science is the manner in which the sensory physiologist has proceeded in his study of the role of the receptors in sensory perception. Although studies involving observation of the intact sense organs have yielded valuable information, a far more adequate understanding of sensory perception has been gained through observations made under ex-

tremely artificial conditions, as when the electrical activity of a single receptor cell and its isolated nerve strand is studied. Such experimentation on the part of the neurophysiologist corresponds to the simple conditioning experiments of the learning psychologist. Both are attempting to discover basic laws and theories that will serve eventually to explain more complex phenomena.

If we examine the structure of any well-developed area of scientific knowledge, such as physics for example, it will be found that the generalizations and theories form a kind of hierarchy. Starting with the variables in particular experiments and the lowest-order laws relating them, we find successively higher-order generalizations involving more and more abstract concepts. Just as the low-order laws serve to unify and interconnect the particular observed facts, so these higher-order generalizations, or *theories* as they are called, provide for the unification of the lower-order laws.

Physicists have been especially successful in formulating highly abstract theories that have served to bring wider and wider ranges of phenomena into orderly relation with one another. One of the earliest examples of this kind of scientific integration was Newton's gravitational principle, which provided for the derivation of both Kepler's laws of planetary motion and the laws of terrestrial mechanics. Another excellent example is Maxwell's electro-magnetic theory of radiation, which served to integrate the various laws of optics with each other and with those of electricity and magnetism.

Quite in contrast to the physical sciences, psychology is as yet in a very primitive state of development. Indeed, in many areas psychologists are still only in the very initial stages of attempting to discover technical concepts that will lead to the formulation of the lowest-order laws. On the other hand, in a few areas they have reached a more advanced stage in which not only have many of the major variables been identified and fairly precise determinations made of the relations holding among them, but attempts to integrate these low-order laws by means of theories have met with some success. The field of learning is one such area. At least in the simplest instances of learning (classical conditioning, simple trial and error learning, discrimination learning, and possibly serial or

rote learning) there has been sufficient development of a body of experimental knowledge to stimulate the formulation of theoretical schemata aimed at integrating the specific laws obtained in each one of these learning situations. Indeed, more comprehensive second-level types of theories are beginning to appear, attempting to deal with all of the phenomena observed in these simpler kinds of learning. These latter theories, of which the formulation of Hull is the best known, consist of abstract concepts and postulates which, in combination with the particular initial and boundary conditions specific to each experimental arrangement, provide for the deduction of the many specific laws that are actually found in these several kinds of learning situations (Hull *et al.*, 1940).

Progress in the development of such theoretically integrated knowledge has, however, been very uneven in the field of learning. As yet, there is little in the way of the lowest-level type of theory for the more complex kinds of learning behavior that psychologists have been investigating. Thus perceptual-motor learning (acquisition of complex skills), problem solving, social learning (acquisition of attitudes and interests), and language learning are instances of learning about which we do not as yet even have very many precisely determined lawful relations. The primary need in these areas is for experimentation in which the known relevant variables are varied in as systematic a manner as possible and in various combinations so that their interaction may be studied. With the development of precise laws in these areas the way will be prepared for the development of low-order theories and eventually the possibility of a more comprehensive, higher-order

theory that will encompass all types of learning from the simplest to the most complex.

While there is, as just indicated, a pressing need for much experimentation in the areas of complex learning, nevertheless progress in the formulation of a comprehensive theory of learning will, in the view of the present writer, be more rapid if at present the major effort of the learning psychologist is directed at investigation of the simpler kinds of learning. Since it is much easier to control and manipulate the variables in these simple learning situations, it is here that we can most quickly obtain the precise quantitative laws we need for making inferences about the exact relationships between hypothetical learning constructs (concepts like *habit strength* and *excitatory strengths*), introduced by psychologists to explain observed behavior changes.

While these simple situations may be artificial and unlife-like, the behavior phenomena they provide are nevertheless real and genuine enough. The subject's behavior does change and in lawful fashion. If we are unable to develop adequate theories to deal with the more precisely described phenomena revealed in these simple experiments, there would seem to be little likelihood of developing adequate theories for the more complex situations. Moreover, since many of the same variables or operations employed in these simple learning experiments (such as reinforcement, non-reinforcement, and punishment) are present also in more complex learning situations, it would seem that many of the same factors and laws would be operative. In this circumstance, it would appear to be more efficient in the long run to concentrate investigation on the simpler learning phenomena.

THINKING

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The experimental investigation of thinking is as old as psychology itself, but today, in the last half of the twentieth century, there seems to be a renewed interest in this topic, or at least in certain phases of the topic, under such names as decision making, troubleshooting, problem solving, and concept formation. This renewed interest comes in part

from the pure scientists, eager to exploit the advantages of theories derived from research on other topics, such as learning and perception. It comes in part also as a response to practical demands: industrial, military, and governmental organizations are asking psychologists to train their personnel to solve problems and make wise decisions.

Thinking is a highly abstract activity; hence progress in the investigation of thinking frequently consists of inventing new methods for coming to grips with abstractions. Some of these were described in Chapter 13. Beginning at this point we can look across the frontiers of present knowledge and try to chart some possible paths of progress for the next fifty years, recognizing, as always in scientific investigation, that some of these paths will turn out to be blind alleys, that many mistakes will be made, and that some of the progress will be in directions that are not even dreamed of today.

It is not possible, of course, to look into the mind and watch the wheels go round, nor is it necessary. One common strategy, very successful in the physical sciences, is to imagine what might be happening or, more precisely, to construct a hypothetical model that can produce the same results. This model may be a mechanical model, or a chemical model, or a mathematical model on paper. If the model behaves in the same way as the real thing, the mechanisms that operate the former may be similar to those that operate the latter, or at least the model will yield some good suggestions.

One interesting capacity of the human intellect is that it can collect information over many years from many sources and then, when faced with a specific problem, select pertinent pieces of information and use them to solve this problem. Several psychologists, brain physiologists, and mathematicians have been impressed by the similarities between such behavior and the behavior of the new electronic computing machines, the "machines that think." One can feed information into such a machine, perhaps on punched cards, and then set the machine to scan its supply of information, or memory, to pick out information pertinent to the problem. This scanning operation is similar to the operation of a human being searching his memory for information pertinent to a problem, so the internal mechanisms may be similar also. The operator sets the machine; the thinker sets himself.

A clue to the appropriateness of this model to human thought is the mistakes that are made. We know that human beings forget, that learning new information interferes with the retention of old information; thus an accurate model of human thought will have to

be different from the present computers, which are constructed to remember perfectly and almost instantaneously. It may be possible, at least on paper, to construct electronic circuits that will duplicate some of the simpler intellectual operations, including failures, and thus yield hints of what the actual mechanisms are. Furthermore, observation of computers and predictions made from mathematical models may tell us how to observe people more sharply and how to design experiments more wisely.

Another difference between man's intellectual operations and the electronic models so far constructed is that man is more easily overloaded. He can respond to a small number of things, perhaps four to eight, depending on the situation; but if we load him up with too much information at once, or if the sequence is too rapid, he overlooks some, or misinterprets some, or blocks completely. Experiments are under way, particularly in England, to determine the limits of attention and the best operating schedules (Mackworth and Mackworth, 1956). Results from such experiments may make it possible to feed information about a problem into a human being in such a way as to take advantage of his capacities for handling all the information and making decisions based on all the facts.

Another topic that is being studied is the making of decisions on the basis of probabilities rather than certain knowledge—for example, in gambling or warfare. We may know, for example, that event A happens occasionally and that when it happens we win a little, that event B happens rarely and that when it happens we win a lot, and so on. Mathematical procedures, called the theory of games, have been developed to combine these probabilities and thus, over the long run, to maximize the amount won.

So far, this is mathematics or logic, not psychology, but now a psychological question arises: Does the ordinary person, who does not know about the theory of games and could not do the calculations even if he did, actually make decisions according to this mathematical model? There is in fact some general agreement between the model and actual behavior. People are likely to take a long chance (one of low probability) when the possible winnings are high; when the possible winnings are low, they expect high probability of winning. But there are serious

deviations from this model. When college students were given an opportunity to bet on a pinball machine, there were distinct non-logical preferences for some bets rather than others (Edwards, 1953). Some people value the long chance more than it is worth; others fear the long chance unduly—especially when playing with real money. So it appears that this simple mathematical model must be broadened to include not only logic but human hopes and fears as well.

This kind of model of decision-making can be applied to the trouble-shooting situation also. When a complicated radar system fails, the failure may, for example, be in circuit A, B, or C. If a repairman knows that 50 per cent of the failures in the past have been in A, 33 per cent in B, and 17 per cent in C, and that seven screws have to be removed to inspect A, four screws for B, and one screw for C, what will he do first? A probability model tells us the sequence that will find the trouble in the least overall time, and recent research shows that experienced radar trouble-shooters do in fact follow such a model strategy in a rough, intuitive way, with some loss of time. They can be trained to make simple calculations and work out the best order of inspection, and beginners can be trained to do so from the outset (Stolurow *et al.*, 1955; Detambel and Stolurow, 1957).

Another strategy for investigating thinking begins not with construction of a hypothetical model but with observation of thinkers in action, in an attempt to analyze complicated problem-solving activities into simpler processes. The separation of learning into parts (acquisition, retention, recall, and so on) has been very helpful, so psychologists have tried for many years to analyze thinking into different processes, usually by asking people to talk while they struggle with a problem. But since thought processes are not self-evident, different experts have arrived at different analyses and there has been no genuine clarification. Today, as psychologists have become more sophisticated about the logic of science, it appears that any classification of problem-solving activities into thought processes is a hypothesis, and nothing but a hypothesis, to be validated by more objective methods.

One recent attempt at such objective validation begins with the "preparation" process. From superficial observation of what people say and do as they work on a problem, many

psychologists have noted that they spend some time on preparation—on assembling and rearranging the problem material—before actually thinking of solutions. At least this is a plausible hypothesis, and if it is true, there ought to be a way of splitting off the preparation process experimentally, perhaps by manipulation of the timing in the presentation of the problem material. The problem material can be separated into two parts, the first part being, in one example, "What letter begins and ends the name of . . ." and the second part being ". . . a well-known lake?" Results to date indicate that when the time allotted to the first is short, the problems that are failed most often are problems that are difficult to assemble and formulate, and that when the second period is short, the problems that are failed most often are those in which the formulation is obvious and the difficulty lies mainly in the production of solutions (Johnson, 1957). The actual times are not important, but experimental manipulation of the timing seems to provide an objective method of describing problems according to the amount of preparation required. Perhaps a period of decision or evaluation of tentative solutions can be split off by a similar method. The overall strategy is to describe problems in terms of hypothetical thought processes necessary for each and then to validate this hypothetical description by objective data on times and errors.

An essential characteristic of thought, as noted in Chapter 13, is that it involves abstractions, such as concepts and mathematical symbols, and it is the very abstractness of these materials that makes research on thought difficult. Nevertheless, methods for studying concepts are already well developed, and in this area the frontiers are being pushed back by an integrated attack by experimental psychologists, social psychologists, and child psychologists. Psychologists interested in learning, particularly in the United States, have demonstrated that learning theories derived from general principles of behavior can explain how some concepts are acquired by animals and young children. This kind of theorizing is now being extended into social psychology because many concepts are learned from other people and reinforced or extinguished in the process of social interaction. Such principles as stimulus generalization, introduced in Chapter 11, help to

explain how a word will evoke the same reaction from a child whether heard or seen.

It would be very convenient for psychologists if children could grow without language, so we could see how they think without the advantages of communication. This is not practical, but it is possible to turn an unfortunate accident to scientific advantage by comparing the thinking of deaf children with that of ordinary children. Because deaf children have not heard anyone say that something is "long" or "heavy" or "round," they have to solve their problems without the concepts and generalizations that children with normal hearing pick up easily in daily communication. The chief intellectual handicap of the deaf seems to lie in just this difficulty of abstract thinking, so some psychologists, especially in France, are adopting a genetic approach, testing deaf and normal children of the same age at several stages to determine just what advantages language confers on the normal child and what type of problem the deaf child, without language, can solve equally well (Oleron, 1957).

Much thinking involves concepts like "warm," which has its meaning in relation to other concepts like "cold" and "hot," or "conservative," which has its meaning in relation to other concepts like "liberal" and "radical." Such terms indicate position on an abstract scale, which is a higher-order concept or dimension. Everyone learns such scales as he

learns concepts, but a person who has grown up among liberals will have a different scale of values from one who has grown up among conservatives, and even a concept like "warm" has different meanings in summer and winter. Psychologists have developed methods of describing these scales with some quantitative precision; it has turned out that they are learned by a kind of averaging process and that they often shift as one's experience shifts. Probability preferences are learned in relation to an abstract scale from 0 to 1.00, and the peculiarities of this scale have also been studied experimentally (Johnson, 1955).

Invention of methods for studying concepts and scales were major psychological achievements, but there are other abstractions used in thinking for which an adequate methodology is not yet available. The formulation of the problem, for example, has not yet been described in any satisfactory way. Presumably the thinker picks out or abstracts from the whole problem situation those parts that seem pertinent and assembles or integrates these into a new pattern or formulation of the problem as he sees it. We know that if a student working on a complicated arithmetic problem formulates it incorrectly, he will get the wrong answer. The psychology of thinking will be greatly advanced when someone invents a method of describing the thinker's formulation of a problem, as his concepts and scales have already been described.

GROUP PROCESSES

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Up to World War II, researchers in social psychology worked to develop an *individual* psychology of the person in social situations. There was much concern about how the individual became socialized as he grew into adulthood and how the adult formed attitudes toward people and issues. Although these interests continue, the focus of postwar research has been on *group* social psychology.

EMERGENCE

OF GROUP PSYCHOLOGY

In the 1920's and 1930's psychologists did a few experiments on groups in the laboratory,

and their colleagues in sociology described the behavior of groups in natural settings. During and immediately after the war, these two interests fused, and a new kind of social psychology emerged. Instead of only studying people's attitudes toward social objects, psychologists began to theorize about how persons interact. Since that time, they have isolated mechanisms—the communication system, the friendship relations, the leadership-followership patterns, and so on—by which groups function. These group processes—in contrast to the psychological processes of the individual members of the groups—constitute a new focus in social psychology.

THE CONTENT

OF GROUP PSYCHOLOGY

Investigators have interested themselves in a variety of group processes. In this rapidly developing field, there is little consensus yet as to how the findings integrate into a consistent whole. Two examples of the work of group psychologists are the studies of *conformity mechanisms* and *group productivity*.

Conformity mechanisms. The traditional social psychologist describes the distribution of attitudes among people, noting conformity to a central mode with deviations from this average. The group psychologist develops theories as to how the group processes work to bring about such conformity. For example, one group of investigators has shown that the amount of pressure exerted on a member depends on how far he deviates from the group's norm. The greater his deviation, the greater the pressure on him to conform. Should the group fail to induce conformity, the deviant member loses membership, and the conformity pressure on him then ceases. These investigators, along with others, also found that the more highly attracted a member feels toward the group, for whatever reason, the greater tendency he has to conform to the group's norms.

Conformity in groups is not exhibited only in overt behavior; it may extend to the person's motives and attitudes and even to such intellectual processes as cognition and visual perception. Consider this example: Two college freshmen, Jack and Fred, want to become members of a particular fraternity. Their common friend, already a member, tells them to watch certain of their own behaviors during the rushing period, especially loud or boastful talk. The freshmen conform and change their outward behaviors. They are pledged.

Months pass, and Fred finds himself more and more a center of attention. "Perhaps it would be better if you'd date girls from such and such a house. The kind you're taking out now don't fit in so well here, Fred." By the end of his freshman year, Fred becomes "one of the fellows," conforming in the relevant areas of behavior—academic (really feeling that the gentleman's "C" is right), social (he now "sees" certain clothes combinations as old-fashioned and unattractive), and athletic

(he knows just how far to play hard and when to be the "good sportsman").

Jack, for a while, is also a center of attention, but at the same time he finds a group of fellows in his dormitory who help him considerably with his engineering mathematics. His attraction toward the fraternity group lessens. As the pledge master puts it, "Jack doesn't take the things we're telling him seriously. He doesn't see things the way Fred does." Gradually the fraternity members leave Jack out of things—"So, let him go his own way." And Jack spends more and more time with his dormitory mates. During the following spring Jack resigns from the pledge class.

In studying such examples as this, the group psychologist is not content with mere description but seeks to penetrate the various processes through which conformity is induced in social situations.

Group productivity. In the past, social psychologists have been intrigued by the differences in problem-solving success between individuals working alone and those working together in groups. Group psychologists now are attempting to understand the internal processes of groups which yield these differing degrees of productivity.

It is not proving easy to discover the intricate relationships which exist between group processes and task characteristics. Under some conditions, as when there is agreement upon goals among the members, groups tend to be more productive when there is more inter-member communication. Yet in other cases, when the task technology coincides with restrictions in communication, productivity tends to be greater with more restriction. How can these seemingly contradictory findings be reconciled?

Or consider this paradox: Under some conditions, increasing the group size results in a reduction in the number of ideas produced. Under other conditions, increasing the group size, at least to a point, produces more permissiveness in the group atmosphere and results in the expression of more ideas.

Even the process of group product formation is being probed. How are individual opinions amalgamated into a final group decision? How does one internal process lead to another, resulting eventually in a particular level of group productivity? Only gradually is a picture of the many determinants of productivity emerging, and as yet there are con-

traditions among the findings which need to be reconciled.

THE OBSERVATION OF GROUPS

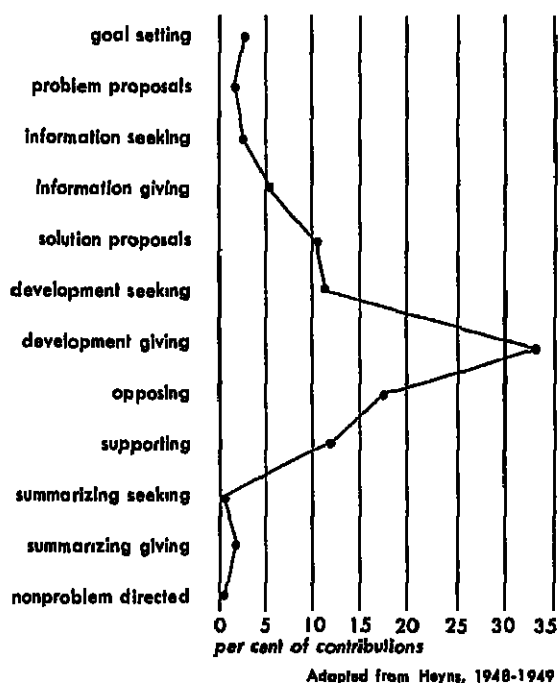
How does one "look at" groups? The most radical elaboration of methodology which has taken place to date in group psychology is an extension of the techniques developed for observing children at play and at school. Researchers now have systems for the direct observation of group members in interaction. These observational systems consist of ways of "unitizing" the flow of behavior into component parts, with simultaneous classification of the units of behavior into categories. Observers can be trained to record the on-sweep of interactions in a group with considerable accuracy. Group psychologists then describe differences in group processes by making "profiles" of the concentrations of behaviors in the interactional categories. This is illustrated in the figure at right for one type of problem-solving group, a decision-making conference.

In some ways the group is more accessible to the psychologist than is the individual. By tapping the communication lines in a group, the investigator has "inside" access to who said what to whom and when. It is possible to "vivisection" the group by removing a leader or by omitting a subgroup. Another way of penetrating the internal processes of a group is to interrupt its progress with questionnaire probes of the members' feelings and perceptions.

As a science develops, an early, tough problem is the isolation of basic dimensions or variables, to provide terms with which its phenomena may be described. The psychologist knows how difficult this has been in the area of personality. Perhaps the technique of factor analysis, which has been so fruitful in describing the basic dimensions of intellectual ability, eventually will yield the dimensions of group process. But at the moment, using the same factor analytic approach, different investigators come up with quite different "factors" or variables. Sometimes these differences are semantic, however, resulting from differences in labeling and already there are some factors which seem to emerge from more than one study, such as "group size," "diffidence in internal communications," "group goal facilitation," and "group identi-

Contributions of All Participants in Four Decision-Making Conferences

problem-solving categories



fication." To date, the ways of measuring these variables have not been standardized by investigators.

OUTPOST AREAS

IN GROUP PSYCHOLOGY

There are outposts even in such a frontier area as the investigation of internal processes in small, face-to-face groups. Two seem of special interest: One block of investigators is pounding at the boundary between individual personality psychology and group psychology; another block is attempting to extend the investigation of internal group processes to the study of organizational behaviors.

Assembly effects. One of the most significant recent advances in group psychology is specification of "assembly" effects, wherein group processes are influenced by the personal characteristics of the individuals who are assembled into groups. In complex group tasks it is possible to induce quite different degrees of productivity, depending upon the personalities of the individuals who are as-



sembled together for group work. One researcher assembled groups in which the participants had compatible values regarding power and personal relations among people. He found these groups were significantly more productive than groups composed of incompatible persons. Note how the basic personality characteristics had an impact upon internal processes of groups: In the incompatible group persons of less ability were assigned leadership roles more often than in compatible groups. With poorer leadership, the incompatibles were less productive.

As our knowledge increases, and depending upon our purposes, it may be possible to assemble personalities in varied combinations to produce different internal group processes, resulting, in turn, in a wide variety of group outcomes. Work on the assembly problems is at the boundary where "personality" meets "group."

Organizational behaviors. During the last decade group psychologists have focused on processes which occur inside the small, face-to-face group. Are the same processes useful in understanding the behavior of larger organizations, where the bulk of interrelations among members occurs in nondirect ways, mediated by third parties? Investigators are now working on the ways in which a simulated organization increases its capacity to handle increasingly complex tasks as its subunits differentiate their functions. In one case, a large 160-man information-processing cen-

ter is being studied. Another investigator has demonstrated the importance of planning activity, as contrasted with local learning of specific roles, in the development of three-level organizational hierarchies. The picture at the left was taken during an experiment in which a contrived social organization was developed in the laboratory (Guetzkow and Simon, 1955). Perhaps most exciting is the deliberate development of groups in isolation, the evolution of hostility between them, and the subsequent reduction of intergroup hostility after working together toward mutually important goals. (See pages 394-395.)

The group psychologist seems to be achieving some success when he explores the operation of group processes in larger organizations. Although there probably are important differences between face-to-face groups and organizations, it is encouraging to find how much of our knowledge of small group processes may be extrapolated to the larger group.

UTILIZATION

Group psychology today is very much a frontier—its variables are not well defined; its findings are not well integrated. Yet, already its results are being applied with vigor. The industrialist is concerned with the production norms of the small, informal group in his factory; he learns how to reduce absenteeism by developing social interdependence in the work team. The teacher of engineering increases the creativity of his class by "brainstorming," a group technique in which the analytic, critical functions of groups are separated from the group processes which enhance ideational fluency. The politician applies the lessons of conformity in creating political-social clubs to replace the vote-getting ward-heeler. The department store personnel director integrates the Negro sales clerk in the cosmetic department through use of the *fait accompli* technique. The marriage counselor obtains insight into the division of functions between husband and wife from findings about role differentiation in small groups. Those concerned with civil defense and administration of relief in natural catastrophes can work more effectively if they understand the power of group loyalties in determining people's behavior in a disaster situation. The social worker increases the co-

hesitance of his settlement groups through his deepened knowledge of group leadership and the psychology of group participation. The United Nations official mediates international conflict more adequately because of his knowledge of discrepancy in group images.

The psychiatrist uses discoveries about the social nature of "reality" in group psychotherapy with neurotic patients.

Little wonder that the group psychologist pioneers with diligence. Beyond him a rich area waits to be explored.*

* The interested student may wish to explore the following for further details about the work now going on in this field: G. Lindzey (ed.) *Handbook of Social Psychology* (Chapter 10, "Systematic Observational Techniques," by R. W. Heyns and R. Lippitt; Chapter 21, "Experimental Studies of Group Problem Solving and Process," by H. H. Kelley and J. W. Thibaut; Chapter 22, "Psychological Aspects of Social Structure," by H. W. Riecken and G. C. Homans); D. Cartwright and A. Zander, *Group Dynamics: Research and Theory*, A. P. Hare, E. G. Borgatta, and R. F. Bales, *Small Groups: Studies in Social Interaction*.

SOME RECENT TRENDS IN OPINION AND COMMUNICATIONS RESEARCH

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During the 1930's many colleges began to introduce courses on public opinion and communications research. In the early phases of development, students in the field were satisfied with simple findings because they were new and interesting. They were usually content to report just the overall distribution of opinion or behavior. What proportion of the population approved of the Administration's foreign policy? How many people read the editorials in their daily newspapers? These were the kinds of questions that were raised at first.

Soon, however, interest turned to the distribution of opinion within certain sectors of the population. To investigate this distribution the samples were stratified—that is, divided into groups—according to a variety of social factors.

Harold Lasswell once stated that the objectives of this whole program of communications and attitude research could be put into one sentence: "Who says what to whom and with what effect." During the second phase of the

field's growth, the method of studying the "what" was systematically developed into the technique of *content analysis*. Berelson described this technique in a textbook published a few years ago, and very little has changed since that time (Berelson, 1952). Studies of the "to whom" are usually called *audience analyses*. They yield less definitive results, because changes in the media or their content modify in turn the behavior of the audience. When television made its appearance on the American scene, for example, the communications habits of the population changed radically; when new types of content are offered, the relative popularity of different kinds of content must be studied anew.†

It was characteristic of this second phase of development that it dealt largely with static materials and resulted in static findings. Not much was learned about the effects of the mass media or the processes by which such effects may be caused. Furthermore, the motives of the communicators, the power structure of the communications industry, and

†Audience studies are carried out constantly, and many of the best are available to students in so-called readers, collections of studies in the field that appear with some regularity. The two most comprehensive readers are B. Berelson et al., *Reader in Public Opinion and Communication*, and W. Schramm, *Mass Communication*. A summary and interpretation of the main research findings will be found in P. F. Lazarsfeld, "Communication Research from the Point of View of the Social Psychologist," in W. Dennis (ed.), *Current Trends in Social Psychology*. Evaluation of the social role of the mass media from many points of view appears in B. Rosenberg and D. White, *Mass Culture*.

the industry's social determinants were never thoroughly investigated.

In the last decade a beginning third phase is discernible. Gradually, the dynamics of the communications process and its social and psychological effects are moving into the limelight of research. The following discussion will sketch briefly three developments that are characteristic of this new phase and will spell out some of their implications.

SUBTLER CHARACTERIZATIONS OF AUDIENCES

It has long been known that major demographic characteristics like age, education, and income affect people's interests and opinions. Slowly, however, we are learning to take into account subtler characteristics, whose relation to media behavior was not previously known.

In one study Eleanor Maccoby had children look at television programs which contained a considerable amount of violence. Before showing the programs, however, the experimenter created a state of frustration in some of the children: all of her subjects had been tested, and some of them were arbitrarily given low marks. Presumably they felt that they were being treated unfairly. Later on, all the children were asked to write down the content of the programs. Those who had been frustrated remembered many more details of violence and aggression (Maccoby, 1955).

In another study it was found that children with rebellious attitudes toward their parents favored comics in which a hero overcomes fantastic difficulties (Bailyn, 1956).

In still another study, comparing isolates and children well integrated with their age-mates, it was found that the well-integrated children were interested in stories and television programs from which they could obtain factual information and around which they could develop new games, while the communication habits of the isolated children were very similar to those of the frustrated and rebellious children in the former studies (Riley and Riley, 1951).

Such findings are interesting not only in their own right but also because they bear on an important practical problem. Many observers have suggested that present-day mass

media have a damaging effect on children's attitudes. Experiments carried out so far indicate that children who already have problems sometimes find these intensified by the mass media, whereas normal children are not very much affected. Problem children need special care in any event; guiding them in their media behavior and discussing with them what they have read or heard may be important modes of helping them readjust themselves. But these studies are in early stages of development, and conclusions drawn from them must be stated tentatively.

To date, there has been very little research on the relationship between psychological characteristics and general attitudes. Of course, there is the well-known study of authoritarianism with its finding that authoritarian individuals tend also to be intolerant of Jews, Negroes, and other minorities (Adorno, 1950). But there is still a strong possibility that this relation is a spurious one: poorly educated people in this country are more authoritarian than better educated individuals, and at the same time they are less tolerant. It may be that poor education, rather than authoritarianism, is the important factor in intolerance and that a general spread of education will lead to the strengthening of democratic attitudes. There is little information on this score, however.

Through questions of this kind, attitude research and study of the mass media are gradually finding a link with another field of psychology, which, for lack of a better term, has been called development of democratic personality. An excellent review of relevant findings was written recently by Maslow (Maslow, 1957).

ROLE OF PERSONAL INFLUENCE

The second major development in the field today is sometimes referred to as rediscovery of the primary group. In the earlier phases one thought of the mass media on the one hand and, on the other hand, of an unorganized mass of isolated individuals who might or might not be influenced by the media. After some time it turned out that important distinctions had to be made within the mass audience, for it became obvious that that audience included people who might be called small-scale opinion leaders. These are

individuals in all walks of life who are likely to be asked advice by other people in their immediate environment: their co-workers, their neighbors, their friends. They are usually gregarious and interested in giving advice.

There are a few general findings which apply to these "influentials." First, exactly who is an opinion leader varies according to the subject matter of advice: the woman who is a leader in housekeeping questions is not usually sought out for ideas on what movies to see. Secondly, the influentials are by no means confined to the "big shots" in the community: in everyday matters working-class people are likely to look to people of their own status. At one time it was thought that ideas and customs originated in the upper class and slowly percolated down to the lower socio-economic strata. Opposed to this idea of *vertical* opinion leadership is the current notion of *horizontal* influence, in which each social, ethnic, or even age group develops its own leadership.

One characteristic which all of these opinion leaders have in common, however, is that they are more likely than others in their environment to read magazines, watch television, and so on. As a result, the idea of a two-step flow of mass communication has developed. Much of the content of the mass media reaches the general population via these opinion leaders. This is not only true for the community at large but for specialized groups as well, like physicians and even farmers. Present knowledge on this two-step flow of communication is well summarized in a paper by Elihu Katz (Katz, 1957).

STUDYING THE DYNAMICS OF OPINION CHANGE

In order to see how attitudes actually change and how the mass media may effect such changes, two things are necessary: first, we must find situations in which changes might occur, and, secondly, once these situations have been identified, we must keep the subjects of our research under observation for a reasonably long period of time. Consequently such research is expensive, both in time and in money.

There is one situation which lends itself quite naturally to these panel methods, as

they are called: an election campaign. A few months before election day the investigators move into the community which they have chosen to study. They ask a representative sample of respondents how they intend to vote and what stand they take on various issues that are likely to assume prominence during the campaign. Then, every six weeks or so, the same people are reinterviewed and asked the same questions about their voting intentions and their opinions. Immediately after election day they are interviewed a final time, to find out whether they actually voted and, if so, for which candidates (Berelson *et al.*, 1955).

There are a number of findings which appear with some regularity in all of these studies. For example, there is a tendency for the voter's opinion structure to acquire greater consistency during the course of the campaign. At the beginning of the campaign people have diverse and sometimes contradictory attitudes: they may be internationalists in foreign affairs but conservatives in economic matters; they may be against the regulation of price controls but for low-cost housing; and so on. Gradually, however, they adapt their attitudes to the platform of the party for which they intend to vote, for in most elections one of the major parties assumes a relatively conservative and the other a relatively progressive position on almost all issues. At the same time, as the campaign progresses there is increasing homogeneity of attitude among friends and acquaintances.

Surveys making use of repeated interviews point up a number of features common to all attitude changes.

One such survey took place in a study designed to trace the effects of a particular film, *Gentlemen's Agreement*, on the public's attitudes toward Jews. The intent of the film was to show that there is still a great deal of hidden social discrimination against Americans of Jewish faith. In order to see what effects the film might have, a number of samples were given a conventional test of anti-Semitism before the film was released in their community. A few weeks later they were asked whether they had seen the film, and their attitudes toward Jews were measured once more. The table on page 554 gives a composite picture of the kind of results obtained in this type of study (American Jewish Committee, unpublished study).

Saw Film

	high intolerance, 2nd interview (total 40)	low intolerance, 2nd interview (total 60)
high intolerance, 1st interview (total 50)	35	15
low intolerance, 1st interview (total 50)	5	45

Did Not See Film

	high intolerance, 2nd interview (total 180)	low intolerance, 2nd interview (total 120)
high intolerance, 1st interview (total 170)	140	30
low intolerance, 1st interview (total 130)	40	90

This study is interesting for a variety of reasons. The findings are not as definitive as might have been expected. For one thing, it turned out that individuals were most likely to see the film when they had a friendly attitude to begin with. And yet some who were hostile to Jews did see the film; we can therefore test whether their attitude is friendlier following their exposure. To a slight degree this is the case, but what is more pronounced is the great shifting back and forth, both among those who saw the film and those who did not. Many exchanged a favorable position for an unfavorable one, but they were replaced by other individuals who moved in the opposite direction.

These changes are very real, and those who experience them can often report how they came about: perhaps they met an unpleasant Jewish person, or, conversely, they may have read of the constructive activities of some Jewish group. There is a steady stream of what might be called molecular influences; these make many individuals oscillate back and forth, but they leave the overall distribution of attitudes relatively unchanged. A single episode like a film is only one very minor particle in this stream of influences. And yet it is not without weight, as we can see from the right-hand side of the table. Those who did not see *Gentlemen's Agreement* show a slight deterioration in their attitudes toward Jews. For a moment this may seem paradoxical: why should not seeing a film have any effect at all? The most likely answer is contained in the argument developed above. These are individuals who, because of a variety of coincidences unknown to us, were exposed to a slightly imbalanced stream of minor positive and negative influences. The deterioration of their attitudes is, in all likelihood, temporary; if a third interview had been carried out, we would prob-

ably have found that the attitude distribution was "normal" once more.

There is no space in this brief review to give a more detailed picture of how much information can be gained when this type of analysis is extended over many interviews and a great number of variables. A good introduction to the topic can be found in Chapter X of Zeisel's *Say It With Figures* (Zeisel, 1957). From what we have said, however, it should be apparent that there are important differences between this mode of analysis, which involves the observation of real processes as they take place over time, and laboratory experiments, best exemplified by the program of Carl Hovland and his associates at Yale University (Hovland *et al.*, 1956).

A laboratory experiment allows one to trace the effects of a specific factor; and the experimenter has a large measure of control over what he wants to know. But he cannot tell whether his findings will apply in a real-life situation. In the analysis of natural time series, on the other hand, there is always the possibility that we have overlooked important factors in our research. But we do gain knowledge of the concrete interplay of those factors which we are studying explicitly.

These differences can be seen clearly if we consider studies of educational broadcasts. If carried out as laboratory experiments, the studies usually show that listeners learn a great deal from such broadcasts. If, however, we have repeated observations, of the kind made in connection with the film *Gentlemen's Agreement*, then we shall find something quite different. Those who would benefit most from such broadcasts tend not to listen to them. The people who do listen are usually well informed to start with and just want a better integration of their knowledge. In other words, the effects of educational broadcasts in real-life situations are much smaller than

laboratory experiments might suggest. In addition, field observations indicate to the educator that methods of attracting the proper audience are at least as important for his consideration as are details of how to develop the program itself.

Neither laboratory experiments nor prolonged field observations on the effects of the mass media can be easily carried out by college students. But there is one approach which has been neglected and to which classroom work could make a significant contribution. Because of the turnover phenomenon—the fact that change in one direction is counteracted by an almost equal amount of change in the opposite direction—the net effect of the mass media, as we have seen, is usually quite small. But the very fact of turnover means that there are a large number of people who have changed their minds about doing something or have modified their opinion on some issue.

There is great need for detailed descriptions of how such minor changes come about. Students could either analyze in detail how some recent attitude change of their own came about, or they could get information from acquaintances. Practically everyone has had pertinent experiences in some sphere of his life: beliefs, buying habits, opinions about other people, interest in hobbies, etc. In addition to providing material that is badly

needed as a foundation for systematic analysis, such projects would give students valuable experience in interviewing and in learning something about how the minds of others work.

We have discussed only short-term changes and effects. As yet there is very little material dealing with long-term changes. The study covering the longest period was conducted by Theodore Newcomb over a five-year period at Bennington College (Newcomb, 1943). There students, many of whom came from wealthy and conservative family backgrounds, were instructed by a faculty that was quite liberal in its traditions. By interviewing these girls every few months, Newcomb was able to show that, slowly, the majority acquired more liberal attitudes of their own, mainly because such change was rewarded by approval on the part of the faculty and greater prestige with the other students. The main exceptions to this general trend were found among girls who remained strongly attached to their families. At the present time, a similar study of medical students is under way (Merton *et al.*, 1957).

These are by no means all the new developments in the field of opinion and communications research. But they will give an idea of the many directions in which the field is expanding and the new techniques that are being employed.

ENGINEERING PSYCHOLOGY

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In most areas of applied psychology our attention is focused upon people. Usually we are concerned with selecting people for jobs, training people, or solving people's adjustment problems. In engineering psychology, on the other hand, what we are trying to select, change, or adjust are not people but the things which people use to perform their work. For example, instead of selecting men who will make good airplane pilots, engineering psychology attempts to reduce the need for pilot selection by making airplanes easier to fly. The engineering psychologist aims to fit the design of devices of all kinds—machines, vehicles, buildings, highways, and even dams—to the capacities, habits, behav-

ior patterns, and body dimensions of the people who will operate or use them—not a particular person but people in general. Thus the engineering psychologist studies people too, just as do other psychologists. But his purpose in doing so is always to find out what effect some equipment design feature will have on human performance.

Engineering psychology is one of the newest areas of applied psychology, having been born in World War II and nurtured by the postwar arms race. Engineers most need the help of psychologists in designing machines for situations which demand exceptional human skill or in cases where human errors can lead to disaster. Both these conditions

hold true for most implements and weapons of war, and most engineering psychologists' efforts to date have been in this field. At the end of World War II this work was limited to small staffs in a few government laboratories. Today it is different; most of the large aircraft, electronics, and other major weapons manufacturers, as well as some manufacturers of civilian products (automobiles, telephones, and appliances, for example), also have human engineering staffs.

In stepping into this new field, psychologists found that some of the problems presented to them could be solved with data already at hand. Other problems called for new research, but research which could use proven methods of studying human behavior.

VISUAL PRESENTATION OF INFORMATION

Vision, of all man's senses, is by far the most important in his operation of machines. Thus it is not surprising that much work has been applied to those parts of machines which give information to the human operator visually. This includes instruments of all types—warning lights, radar scopes, telescopes, sights, lighting systems, and all types of printed materials and signs.

Paterson and Tinker's experiments on the legibility of print, performed before World War II, are still the basic source of information on how to make printed materials most readable (Paterson and Tinker, 1940). Many of the problems in lighting work spaces and instruments can likewise be solved with older data. An example is the use of red light in aircraft cockpits and other places where the operator's visual sensitivity for dim light must be kept at a maximum. That red light is most favorable for preserving dark adaptation has been known for quite some time.

More difficult to solve are the problems concerning what visual presentations the operator can most easily interpret and translate into action. Most instrument and radar scope design problems are of this sort. The experiment by Grether on reading aircraft altimeters serves as an example (Grether, 1949). The numbers and scales on the different altimeter designs were equally visible, but there were enormous differences among the instruments in reading time and number of

reading errors. Moreover, the instruments that took longest to read tended to produce the most reading errors. This is the usual finding: designs which favor the most rapid action generally also produce the fewest human errors.

Probably the greatest contribution of psychologists to the improvement of visual presentations on instruments is the work of Birmingham and Taylor on what they call "quickenings"—speeding up the information which the instrument supplies to the human operator (Birmingham and Taylor, 1954). For example, suppose you wish to accelerate to and hold your car at fifty miles per hour. There is quite a delay between the time you press down on the accelerator and the time the speedometer needle reaches fifty. The novice will tend to overshoot and then oscillate about his desired speed. If we applied quickening in this case, we would have an additional instrument showing on a single needle an additive combination of accelerator pedal position and miles per hour. This needle would tell the driver at all times whether or not he had the proper pedal position to reach and hold the desired speed. Although such quickened information is unnecessary for driving cars, there are situations in controlling military equipment where the application of quickening has resulted in considerably improved human control.

DESIGN OF CONTROLS FOR HUMAN OPERATION

Intimately related to the information we present to the human machine operator are the controls we give him—the wheels, levers, pedals, cranks, switches, push buttons, and so on with which he does his work. To be most effective, these must be designed to fit not only the human operator's basic manipulative abilities but also the habits and skills already developed through past experience with other devices. Besides this, there must be a proper and logical relationship between the movements of the controls and the visual instruments which they affect.

One of the pioneering studies on design of controls was carried out by Jenkins on shape coding (Jenkins, 1947). Many aircraft accidents had occurred because pilots had operated the wrong control lever. As an

approach to this problem, Jenkins experimentally worked out families of knob shapes which were easily identified by touch and were rarely confused with each other. On the basis of Jenkins' original studies, his knob shapes were slightly modified to increase their resemblance to the things they controlled, and were then standardized for use in military aircraft. The positions of the controls in the cockpit were also standardized, as a further aid to identification. As a result of these two changes, certain types of aircraft accidents, such as those resulting from confusion between landing gear and flaps, were almost totally eliminated. Probably more important than the design of individual controls are other, more complex factors, such as the arrangement of controls in the work space and the directions in which they move. From ingenious work by Warrick and numerous other psychologists, we now know many of the answers to the problem of how controls should be arranged and how they should move for most efficient human operation (Warrick, 1947). As is often the case in science, the general rule or law turns out to be quite simple. The control should move in the same direction as the resulting movement of the indicator or part of the machine being controlled. When there are multiple controls, they should be arranged in the same general pattern as the indicators or parts of the machine which they control. The term "compatibility" has been used to describe this relationship of the controls (in either arrangement or movement) to whatever they control.

MAN VERSUS MACHINES

Engineering psychologists often find themselves comparing man with machines or trying to describe human capabilities in the same terms engineers use to describe mechanical devices. Often, in fact, a choice must be made as to whether to have certain operations or functions performed by human beings or by automatic devices. With the rapid advancement of computer technology, more and more tasks formerly done by men are being done wholly or in part by automatic means.

Yet the purpose of describing human capabilities in engineering terms is not to reduce man to the level of machines. One reason for the use of engineering terms is apparent in

situations in which the human plays a vital part in a complex control system. To design the control system so that it will properly match the human being, it is helpful to be able to describe human behavior with the same type of mathematical equations as those used to describe the mechanical and electrical parts of the system. If the human component can be handled mathematically, then the whole system can be simulated and tested mathematically before it is built.

As an example of the type of problem in which we wish to describe human behavior by mathematical equations, we can consider the control system of an aircraft. At high speeds the forces on the plane's control surfaces, rudder, elevator, and ailerons are much too great for the pilot to cope with through his own strength. Therefore, servomechanisms are used to supplement the power which the pilot can apply, much like power steering on an automobile. But this added power can get out of control and destroy the aircraft unless it is matched to the pilot's capabilities, including his reaction time and speed of movement. If the servobooster reacts too quickly, the pilot may overcontrol and be unable to keep the aircraft on a straight and steady course. On the other hand, if the servobooster has too slow a response, the pilot will be unable to perform rapid maneuvers.

Quite a number of psychologists, working with engineers, have tried experimentally to find a mathematical representation of human tracking behavior, as in flying an airplane or steering an automobile. For human tracking to be described by a simple equation would require that the output (response) always have a constant ratio to the input (stimulus). This is impossible, but for quite restricted situations a usable equation has been found to be a close enough approximation to be helpful to the design engineer.

If we can reduce human behavior to mathematical equations, then why cannot engineers design automatic devices to replace people entirely as operators of machines? About this we need not worry, at least for the foreseeable future. Only relatively simple human performance can be approximated by mathematical equations and duplicated by machines. It is doubtful whether machines will ever be able to match us in versatility,

in ability to learn and think, or in ability to create new and better machines.

A GLANCE AT THE FUTURE

In 1956 the Society of Engineering Psychologists was formed as a division of the American Psychological Association. This event indicates that engineering psychology has a recognized place in psychology. For this new and growing field there is much work still to be done. In general, it is the easier problems which have been attacked and solved, while the more difficult ones remain to challenge future research workers.

For example, a preponderance of our human engineering research has been in the context of one human being operating one machine (or part of a machine). Many of the design problems faced by engineers are much larger than this and involve truly complex systems operated by teams of people. Psychological research on such systems teams becomes exceedingly costly in both time and labor and has been attempted in relatively

few instances. Our methods of performing such research are still in their infancy.

A second problem arises from the fact that the older profession of engineering is accustomed to working with exact quantitative data which can be manipulated mathematically. Most psychological findings are not of this type. To make our data of maximum utility to engineers, we must make our human engineering data more amenable to mathematical treatment.

A third and rather different problem for engineering psychologists is their professional relationship to the engineers whom they serve. Some engineers have expressed concern about competition from psychologists in the field of equipment design, and there is some justification for this concern. Many of us, however, believe that the application of psychological data to engineering design must in the long run be performed by engineers themselves, rather than by psychologists. Psychologists can make the most valuable contribution through research and through the translation of research findings into design data and principles which engineers can apply.

THE BRAIN AND NERVOUS SYSTEM AS AN INTEGRATING MECHANISM

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Despite the phenomenal growth in our knowledge of the brain and nervous system in the past century and a half, information in this field has lagged far behind the needs of the rapidly growing science of psychology. Even today, the role of the brain and nervous system in the simplest sensory experiences or motor reactions is not completely understood. Our knowledge about *what* an organism can perceive, learn, remember, and do is much greater than our understanding of *how* such processes occur.

In recent years, however, research has been bringing us new discoveries and new concepts of brain and nervous system functioning which vastly increase the "solid ground" on which an understanding of psychological process can be built. Four of these discoveries will be discussed here.

ELECTRICAL ACTIVITY OF THE BRAIN

In 1929 a German neuropsychiatrist, Berger, demonstrated that the nervous system is not a mere standby system, active only when incoming sensory messages arouse it to activity, but that it is continuously active electrically. During normal waking, as you have seen (page 152), the cerebral cortex characteristically has smooth, rhythmic "alpha" waves, with about ten oscillations per second. When interrupted by sensory stimulation, the waves become faster, less rhythmic, and of lower amplitude. Drowsiness, on the other hand, tends to reduce the size and frequency of the waves; if it continues, slow waves of three to five oscillations develop, with short bursts of more rapid waves called "spindle

Psychological States and Their EEG, Conscious and Behavioral Correlates

behavioral continuum	electro-encephalogram	state of awareness	behavioral efficiency
strong, excited emotion (fear) (rage) (anxiety)	desynchronized; low to moderate amplitude; fast, mixed frequencies.	restricted awareness; divided attention; diffuse, hazy; "confusion."	poor; (lack of control, freezing-up, disorganized).
alert attentiveness	partially synchronized; mainly fast, low amplitude waves.	selective attention, but may vary or shift; "concentration" anticipation, "set."	good; (efficient, selective, quick reactions) organized for serial responses.
relaxed wakefulness	synchronized; optimal alpha rhythm.	attention wanders—not forced; favors free association.	good; (routine reactions and creative thought).
drowsiness	reduced alpha and occasional low amplitude waves.	borderline, partial awareness; imagery and reverie; "dream-like states."	poor; (uncoordinated, sporadic, lacking sequential timing).
light sleep	spindle bursts and slow waves (larger) loss of alphas.	markedly reduced consciousness (loss of consciousness) dream state.	absent
deep sleep	large and very slow waves (synchrony but on slow time base) random, irregular pattern.	complete loss of awareness (no memory for stimulation or for dreams).	absent
coma	isoelectric to irregular large slow waves.	complete loss of consciousness; little or no response to stimulation; amnesia.	absent
death	isoelectric; gradual and permanent disappearance of all electrical energy.	complete loss of awareness as death ensues.	absent

From Lindsley, 1932

bursts," and both introspection and objective observation indicate that the individual is going into a light sleep. With deeper sleep, the spindle bursts disappear, and there is further slowing and enlarging of the waves. The table above shows the brain waves characteristic of several levels of consciousness and the awareness and performance efficiency that can be expected with each one.

The EEG pattern has thus become a valuable index of the state of activity of the cerebral cortex, much more precise and dependable than either introspection or observation of the individual's behavior. And with this measure of cortical activity it has become possible to study both the influence of other structures on cortical activity and its influence on them.

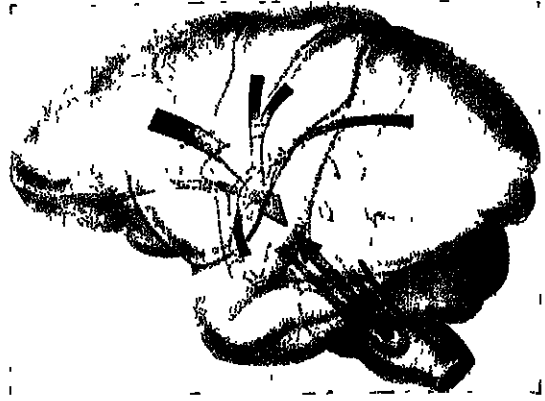
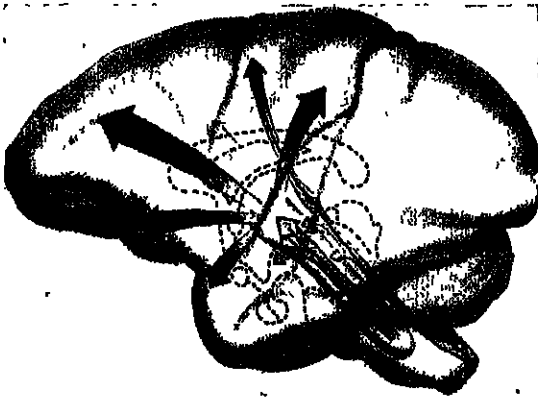
AN AROUSAL AND ALERTING SYSTEM IN THE BRAIN

Studies of the electrical activities of the cortex, together with changes in behavior, have recently enabled investigators to identify previously unsuspected functions of a portion of the lower brain stem. Extending

from the medulla through the pons and mid-brain is a neural structure known as the *reticular formation*. It has long been known as a densely packed and tangled network of neurons but until recently was regarded only as a possible mediator of brain stem reflexes. It has now been shown to have important influences on neural activity both above it in the brain and below it in the spinal cord.

Exploring electrically the sensitivity of various brain stem structures in a cat, the investigators observed two surprising effects. Stimulation of the reticular formation aroused a drowsy or sleeping cat and alerted a waking one. Second, it changed the pattern of electrical activity in the brain in the ways that would be predicted from the table above—that is, the synchronized, slow waves and spindle bursts present in the drowsy cat changed to the low amplitude, fast, desynchronized waves characteristic of a wide-awake animal alerted by sensory or emotion-provoking stimuli. (Moruzzi and Magoun, 1949).

Next, the investigators demonstrated that when a sensory stimulus aroused an animal, corresponding electrical potentials could be



Above are two lateral views of a monkey brain, showing schematically the structures discussed in the text. On the left is depicted the whole upward extension of the reticular formation, called the *ascending reticular activating system* (ARAS) and the collateral fibers leading to it from the sensory pathways (Magoun, 1954). On the right are indicated the sources of stimulation on the cortex which give rise to potentials in the reticular formation. By these mechanisms cortical events and ideation can presumably influence the ARAS, whose excitation, in turn, reactivates the cortex (French, Hernandez-Peon, and Livingston, 1955).

recorded in the reticular formation as well as in the cortex. Thus it became evident that the reticular formation of the lower brain stem is a kind of second sensory system, important in both the control of behavior and the electrical activity of the brain.

Further work soon established the fact that if a cat's brain stem is severed at progressively higher levels, the brain becomes progressively less able to maintain the electrical activity typical of a waking state. When the reticular formation is severed near the junction of the mid-brain and the hypothalamus, the brain waves become like those in sleep (Lindsley *et al.*, 1949). This is proved to be the result of the interruption of the reticular formation by the fact that when the ascending sensory pathways running beside the reticular formation are severed and the reticular formation itself is left intact, the electrical activity continues in a characteristic waking state. On the other hand, when the reticular formation is cut off and the sensory pathways left intact, the animals become somnolent with corresponding brain waves and can be roused only briefly by strong stimuli (Lindsley *et al.*, 1950).

It now seems clear that sensory stimulation not only is conducted to specific regions of the cortex, as described on pages 484-486, but also arouses the reticular formation through collateral fibers from the sensory pathways where they pass close to it in the brain stem.

Furthermore, when an animal is under light anesthesia, in which the reticular formation is the first system to be depressed, sensory messages continue to pass through the sensory pathways and reach the appropriate areas of the cortex (as proved by electrical activity of the cortex), but the subject is unable to decode and discriminate such messages. Evidently the participation of the reticular formation is essential to normal perception.

Here, then, is a mechanism capable of arousing or alerting an animal, and also intimately concerned with controlling attention and perceptual discrimination. Probably it plays some role in the regulation of motivation as well. Such a mechanism, hitherto unknown, goes a long way toward helping to explain some of the phenomena of psychology. Meanwhile, research into control originating in the cortex is filling in still other parts of the picture.

CENTRIFUGAL

FEEDBACK CONTROL

Not only does stimulation of the reticular formation produce electrical activity in the cortex; the reverse is also true, as indicated in the figure above right. It has been found that stimulation of a number of areas of the cortex gives rise to electrical potentials in the reticular formation. This is taken as an indication that activity in these areas of the cortex influ-

ences the activity of the reticular formation and, through it, the individual's overt behavior and subsequent cortical potentials (French, Hernandez-Peon, and Livingston, 1955). Thus, for example, it is assumed that ideas growing out of past experience or present problems involve cortical activity which generates activity in the reticular formation; its activity, in turn, tends to keep the brain awake and alert and to produce corresponding overt behavior, even in the absence of any sensory stimulation. Such a mechanism explains how worries and anxieties can lead to insomnia.

It has been further demonstrated that either cortical or reticular activity may suppress incoming sensory messages, thus regulating the flow of information which comes to us from our environment in much the same way that a radio with an automatic volume control cuts down the volume if the signal becomes too strong (Lindsley, 1956).

Still another possible regulating influence should be mentioned. There is some evidence that the peaks and troughs of the brain waves correspond to an alternating excitability cycle, with excitability during parts of the waves, perhaps the peaks, and lack of excitability during other parts, perhaps the troughs. With a ten-per-second alpha wave there would thus be ten interruptions per second in the influx from any sensory channel. Such interruptions may be thought of as analagous to the process by which a shutter on a movie projector shuts off projection while the next frame of the film moves into place. When successive frames appear as often as sixteen per second, there is sufficient carry-over so that the picture appears to be continuous. Apparently a kind of neuronie shutter mechanism in the brain operates during normal perception at the rate of about ten times a second.

It is interesting to speculate on the function of such a mechanism. Certainly it would provide for flexibility, since shifts of attention from one special aspect of a stimulus situation to another might occur during the inexcitable interval without any apparent interruption in the foregoing process. As we scan a visual field, we seem to be able to pay attention to several things at a time, but it may be that actually there are rapid shifts of our attention which we have learned to overlook. By shifting back and forth from one thing to another

every tenth of a second, we may actually be scanning different parts of our "cortical screen" and integrating into an apparently continuous whole many messages that actually have reached the brain separately over different channels. If this were *not* the case, and if all sensory channels had constant access to the cortex, our experiences would be chaotic indeed. Some such timing of messages arriving in the different sensory receiving areas seems essential in order for interaction and association, instead of confusion and blocking, to take place.

There is evidence that some of this temporal integrating may be carried out by the thalamus, through which all incoming sensory messages pass just before they are projected on the different areas of the cortex. The thalamus also has close linkages with the ascending reticular system. The exact manner in which the reticular formation, the specific relay systems from the thalamus, and the diffuse projection systems from the thalamus all influence cortical activity is not known, but they seem closely related (Jasper and Ajmone-Marsan, 1952).

We may expect further understanding of these structures to cast more light on the processes of attention, perception, and perhaps conditioning. It may well be that one way in which they act is by modifying, regulating, and controlling cortical rhythms which, in turn, regulate the flow of messages to, within, and from the cortex.

EMOTIONAL AND MOTIVATIONAL MECHANISMS

You have already seen on pages 502-504 that recent research into the functions of the hypothalamus and the rhinencephalon have greatly increased our understanding of these regions. Areas formerly thought to be concerned chiefly or entirely with olfaction are now known to be important in the regulation of emotional behavior, drives, and possibly memory, conditioning, and learning (Lindsley, 1956). Recent studies suggest all these possibilities and more, but much of the work is as yet unconfirmed; more research will undoubtedly be carried out in the near future.

Only one facet of the recent work will be mentioned here, since it was discussed at some length earlier. You have seen that rats taught to press a bar to obtain food also press

the bar repeatedly when it results in a minute electric shock in certain sections of the brain, such as the forward part of the hypothalamus. Similar shocks in other areas are less effective or not effective at all. This discovery has been put to use in studying the effects of tranquilizing drugs as well as in studies of drive strength and in attempts to locate the mechanisms that are active in different drives (Olds, 1955, 1956a; Olds *et al.*, 1956). This research has been summarized recently in a popular scientific article in which the investigator has stated as a tentative conclusion "that emotional and motivational mechanisms can indeed be localized in the brain; that certain portions of the brain are sensitive to each of the basic drives" (Olds, 1956b).

EPILOGUE

Often in the history of our study of the brain, sudden and important advances have been made possible by the development of new techniques of study. Thus, with the development of surgical skill, dissections became possible with greatly advanced knowledge of the gross anatomical features of the brain. This led eventually to removal of portions of the living brain and to studies of behavior and capacities before and after such removal. With the improvement of the microscope and the development of ways of slicing thin sections of the brain and staining them, it became possible to study the finer structure of the brain. Next it was discovered that local application of electric current to certain parts of the cerebral cortex produced movements

of limbs or muscle groups, and the motor area was mapped as you saw on pages 483-484. Finally, it was discovered that muscles, nerves, and even brain tissue generate small electric currents which may be detected and recorded.

Various combinations of all the techniques mentioned are in use today, and new refinements are appearing constantly. For example, with the electron microscope it is now possible to study the structure of a single nerve cell, and electrodes have been made which are so small that they can record the electrical potentials from a single cell.

New and exciting advances are being made on all fronts today. Yet much remains to be done. For example, though we now have identified many of the structures involved in perception, we still do not know just how all the characteristics of our visual world are coded into the nerve impulses that carry the information to the brain. Nor do we know how these messages are decoded and stored in the brain or how they interact with what has been stored from previous experience. Neurophysiologists need the help of psychologists in devising new and better techniques of studying and analyzing perception, conditioning, learning, memory, thought, and so on. We need much more interdisciplinary cooperation and interaction in formulating problems, developing new techniques, and carrying out research. And we need young people coming into the field with knowledge and experience in psychology, physics, chemistry, electronics, and mathematics and an eagerness to pioneer in the development of original techniques and new ideas.

These ten articles have given you a glimpse of some of the keenest psychologists' minds in action. You have seen how they labor for an ever expanding comprehension of the thinking, feeling, and doing of man—alone and in groups.

You have seen that many views of man are useful and fruitful; that progress comes by stages, with many false starts and blind alleys; and that what we know of man today is merely a beginning from which we can go forward to new frontiers.

ACKNOWLEDGMENTS

This edition of *Psychology and Life* has been made possible through the cooperation of many psychologists and special sources. For the most part, professional services are acknowledged through the bibliographical references or on the page where the illustration appears. Additional sources of illustrations are listed below. To all, the author and publisher wish to express their appreciation.

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 Am. J. Psychtry.—American Journal of Psychiatry
 Am. J. Soc.—American Journal of Sociology
 Am. Psychgst.—American Psychologist
 A. S. R.—American Sociological Review
 Arch. Psych.—Archives of Psychology
 Ed. Psych. Meas.—Educational and Psychological Measurement
 J. Ab. Soc. Psych.—Journal of Abnormal and Social Psychology
 J. A. M. A.—Journal of the American Medical Association
 J. Appl. Psych.—Journal of Applied Psychology
 J. Clin. Exp. Hyp.—Journal of Clinical and Experimental Hypnosis
 J. Com. Phys. Psych.—Journal of Comparative and Physiological Psychology
 J. Com. Psych.—Journal of Comparative Psychology
 J. Cons. Psych.—Journal of Consulting Psychology
 J. Ed. Psych.—Journal of Educational Psychology
 J. Ed. Res.—Journal of Educational Research
 J. Exp. Psych.—Journal of Experimental Psychology
 J. Genl. Psych.—Journal of General Psychology
 J. Gent. Psych.—Journal of Genetic Psychology
 J. Psych.—Journal of Psychology
 J. Soc. Psych.—Journal of Social Psychology
 Pers. Psych.—Personnel Psychology
 Psych. Bul.—Psychological Bulletin
 Psych. Mono.—Psychological Monographs
 Psych. Rev.—Psychological Review
 Pub. Op. Q.—Public Opinion Quarterly
 Res. Pub. A. R. N. M. D.—Research Publications of the Association for Research in Nervous and Mental Disease
 Prdgs. A. R. N. M. D.—Proceedings of the above
 S. N. L.—Science News Letter
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GLOSSARY

Listed below are the important terms used in *Psychology and Life*. The definitions given here are based on the usage of this book. The numbers in parentheses following each definition refer to the page or pages in the text where the term is discussed *most fully* in context.

- Ability.** Quality or quantity of actual performance. (93)
- Absolute savings score.** Difference between amount of practice required for original learning of a given task and the amount of practice required to relearn it. This savings is sometimes expressed as a percentage of the original learning score and called the relevant savings score. (315)
- Absolute threshold.** See *Limen*.
- Absolute refractory phase.** Period immediately following a nerve impulse when the nerve is incapable of responding to even very strong stimuli. (483)
- Abstraction.** Process of developing concepts; that is, grouping objects in terms of some distinguishing common property. (352)
- Accident proneness.** The tendency of certain individuals to have more accidents than other people. (475)
- Accommodation.** Process by which the lens of the eye increases in thickness to focus on near objects and flattens for distant vision. (239)
- Acquired drive.** A drive that is not innate but is learned as the result of experience. (124)
- Acromegaly.** An overgrowth of certain portions of the skeleton (notably the hands, arms, jawbone, and chest), caused by an oversecretion of the pituitary growth hormone during adulthood. (46-47)
- Action-current method.** Method of determining functions of different brain areas by correlating the areas of greatest electrical activity with the kind of stimulus being applied or the type of activity being carried out by the subject. (489-490)
- Action currents.** Small but measurable electrical impulses produced by contracting muscles or by nerve impulses. (355, 489-490)
- Active touch.** The experience of touch involving muscle sense as well as pressure—as when we pass our fingers over surfaces that produce different degrees of resistance. (260)
- Adaptation.** Adjustment of the sense organs to stimulation or lack of stimulation. (236)
- Additive color mixture.** The mixture of lights, in which wave lengths of the different colors are added together. (247)
- Adjustment process.** The continuous process of attempting to overcome inner and outer obstacles to the satisfaction of biological and social needs. (15)
- Adrenal androgens.** Hormones secreted by the adrenal cortex which regulate the development of secondary sex characteristics, particularly those associated with masculinity. (48)
- Adrenal cortex.** Outer layer of the adrenal glands; secretes the adrenal androgens and other hormones that influence maturation. (48)
- Adrenal glands.** Endocrine glands located at the upper end of the kidneys; consist of inner adrenal medulla and outer adrenal cortex. (48)
- Adrenal medulla.** Inner core of the adrenal glands; secretes the hormones adrenaline and noradrenaline when the individual is under strong emotion. (48)
- Adrenaline.** Hormone secreted by the adrenal medulla in strong emotion; causes a number of bodily changes, including an increase in blood sugar, a rise in blood pressure, and a more rapid pulse rate. (48, 151)
- Affective processes.** Emotional processes which make us perceive a particular thing as pleasant or unpleasant. (272)
- Afferent neuron.** Neuron which carries messages toward the central nervous system from a receptor cell; also known as sensory neuron. (485)
- Afterimage.** See *Negative after sensation* and *Positive after sensation*.
- Aggressive reaction.** A response to frustration by attacking the source of frustration or some substitute. (178)
- Agnosia.** A disorder of perception in which sensations are felt but cannot be organized into normal perceptions; usually caused by lesions in the association areas. (496)
- Agraphia.** Loss of the ability to write, caused by lesions in the association areas. (496)
- Alarm reaction.** See *General-adaptation-syndrome*.
- Alexia.** Inability to recognize printed words, often called "word-blindness." (496)
- All-or-none principle.** Principle that if a nerve fiber responds at all, it responds with full strength. (483)
- Alpha rhythm.** The electrical rhythm typical of the brain during normal wakefulness; about ten oscillations per second. (154)
- Ambivalence.** The experiencing of both positive and negative feelings toward the same person or object (215)
- Amnesia.** Loss of memory, especially of past personal experiences. (189-190)
- Amniotic fluid.** Fluid in the sac enclosing embryo during prenatal development; serves to equalize pressure on embryo. (37)
- Ampullae.** Swellings at the base of the semicircular canals; contain hair cells which are the chief receptors for rotary motion, especially accelerating or decelerating motion. (260)
- Angrydala.** Area in the rhinencephalon whose destruction causes excessive sexual behavior but a cessation of rage and savageness. (503-504)
- Analytic tests.** Tests which measure the separate component traits into which complex performance patterns can be analyzed. (68)
- Anatomical method.** Method of studying brain functions by tracing nerve pathways in nonliving tissues under a microscope. (480)
- Anoxia.** Lack of sufficient oxygen. (340)
- Anthropology.** Study of the physical evolution of

- mankind, the origins of races, and the development of civilizations and cultures. (18)
- Anvil. The second of three hinged bones in the ear (the others being the hammer and stirrup) which together transmit vibrations from the eardrum to the oval window. (254)
- Anxiety. Generalized feelings of worry and apprehension; a symptom of many neuroses. (185)
- Anxiety neurosis. Abnormal reaction pattern in which anxiety (free-floating or generalized worry or apprehension) is the principal complaint. (185)
- Aphasia. Impairment of ability to use or understand language, even though hearing and speech mechanisms are unimpaired; usually associated with lesions in the association areas close to sensory areas of the cortex. (496)
- Apraxia. Defective ability to perform common manipulation in the absence of real paralysis; caused by impairment of the association areas near the motor areas of the cortex. (496)
- Arithmetic mean. Measure of central tendency, more familiarly known as the average; obtained by adding the scores together and dividing the sum by the total number of scores. (86)
- Ascending reticular system. System of ascending nerve fibers over which impulses go to the cortex from the subcortical areas. (505, 506) See also *Reticular formation*.
- Assembly effects. The effects on group processes and group productivity of the personal characteristics of group members. (549-550)
- Association. A working relation between a stimulus situation and a particular response. (319)
- Association areas. Areas of the cerebral cortex which serve to correlate and integrate the simpler functions of the sensory and motor areas. (493-494)
- Associationism. Theory that learning is a process of forming associative bonds or connections between stimulus impressions and response tendencies; some but not all associationists believe that association involves a connection of some sort in the nervous system. (319)
- Astereognosis. Loss of ability to recognize solid objects through the sense of touch. (496)
- Astigmatism. Visual defect caused by unequal curvature of the cornea, producing clear vision in one dimension but unfocused, fuzzy vision in the other. (244)
- Atmosphere effect. A form of "set" in which the individual's response is colored by the general tone of the situation. (367)
- Atmospheric perspective. Differences in clarity between near and far objects; an aid in depth perception. (288)
- Attention. The process of psychological selectivity by which we select, from a vast number of potential stimuli, only those which are related to present interests and needs; a limiting factor in determining what we perceive. (266)
- Attitude. An emotionalized system of ideas which predisposes us to act in a certain way under certain conditions. (305)
- Attraction-repulsion. Form of conflict frustration in which the individual is at the same time attracted and repelled by two closely associated objects or by different aspects of the same object. (172)
- Auditory canal. Canal leading through the outer ear to the eardrum. (254)
- Auditory nerve. Nerve which transmits impulses from the Organ of Corti to the brain. (254)
- Autistic thinking. Thinking which is determined primarily by the individual's needs or desires; tends to be indulged in for self-gratification without necessary regard to reality, as in daydreaming. (357)
- Autokinetic movement. The apparent movement of a small stationary point of light in a dark room. (280)
- Autonomic nervous system. That part of the nervous system that regulates activities not generally subject to voluntary control, including the visceral changes that occur during emotion; its activities are divided between the sympathetic and parasympathetic divisions. (499-500)
- Axon. Long fiber leading from the cell body of the neuron, terminating in end brushes. (482)
- Band wagon. Persuasive device by which people are encouraged to do something because a great many other people are doing it. (438)
- Bargain. Type of leadership in which leader and group members work out a trade whereby the desires of each will be satisfied. (385)
- Basilar membrane. Membrane in the cochlea on which is located the Organ of Corti; varies in width and responds selectively to impulses of different frequencies, being more responsive to impulses of lower frequency as it becomes wider. (254)
- Behavior. Isolated reactions and organized, goal-directed patterns of reaction which can be observed objectively; also internal behavior, such as thinking and emotional reactions, which can only be observed introspectively or inferred from external behavior. (12)
- Behavior pattern. A sequence of actions which the organism employs to adjust to a situation; for each behavior pattern there is an underlying neural pattern. (16)
- Behavior sampling. Technique for measuring personality traits; the examiner observes the subject's behavior in a typical situation, unknown to the subject. (77)
- Behavioral science. A coordinated discipline in which psychologists, sociologists, and anthropologists work together on the problem of developing valid generalizations about human behavior in group situations. (13)
- Behaviorists. School of psychology which restricted its study to man's overt behavior, believed to be determined by a complex system of independent stimulus-response connections. (12)
- Bell-shaped curve. See *Normal distribution curve*.
- Bimodal curve. Graphic picture of the distribution of a trait in which the cases cluster about two extremes rather than about the middle. (85)
- Biographical inventory. Standardized application blank. (458)
- Biographical method. Technique by which the psychologist seeks to understand behavior by analyzing the records of men's lives. (24-25)
- Biological drives. Innate drives resulting from basic tissue needs. (124-125)
- Blind-position reaction. Control system in which the individual cannot tell whether his response is accurate or not until it has been accomplished. (472)
- Body-type theories. Modern characterological conceptions which attempt to relate the individual's body build to his total personality structure. (7)

Brain potentials. Brain waves; minute electrical oscillations given off by the cerebral cortex; measured by the electroencephalograph. (154)

Brain stem. Most primitive part of the brain; an extension of the spinal cord; contains medulla, pons, and various nuclei. (481)

Brightness. Quality of color determined by the amplitude (height) of the light wave; greater amplitude causing a brighter (lighter) color. (246)

Brightness adaptation. Absence of dark adaptation; occurs immediately with visual stimulation under normal illumination. (239)

Brightness contrast effect. The apparently greater brightness of gray against a dark background than of the same gray placed on a white background. (248)

Broca's area. Area in frontal lobe of cerebral hemisphere just above the fissure of Sylvius; important for speech ability. (494)

Capacity. Potential ability or "trainability." (93)

Card stacking. Persuasive device in which facts are selected to give a false impression without actually lying. (438)

Castration. Surgical removal of the testes. (49)

Catatonia. Schizophrenic reaction characterized by alternation between disturbed emotional reactions and completely motionless, unresponsive stupor. (201)

Catharsis. The discharging of emotional tension by "talking out" or otherwise expressing troubled emotions; important in most types of psychotherapy. (210)

Cathexis. As used by psychoanalysts, the investment of emotional significance in an idea, memory, object, or activity. (539)

Centile score. Point below which a given per cent of the cases of a distribution fall, the median being the 50th centile. (87)

Central nervous system. The central part of the nervous system, consisting of the brain and spinal cord. (480)

Central sulcus. See *Fissure of Rolando*.

Cerebellum. The part of the brain that controls the coordination of movements necessary for balance in sitting, walking, and manipulation. (43)

Cerebral cortex. The part of the brain associated with conscious experience and higher mental processes; a thin, grayish rind of tissue covering the cerebrum. (48, 489)

Cerebral dominance. Control of both sides of the body in certain functions by one side of the cerebrum; responsible for handedness. (497)

Cerebrotonia. Personality type characterized by a tendency to be asocial, unamiable, susceptible to pain, unadventurous, and lacking in desire for exercise; associated in Sheldon's classification with the ectomorph. (9)

Cerebrum. The main part of man's brain, divided into right and left hemispheres; also known as the new brain. (488-489)

Channel. In communication, the link which connects source and destination of information energy. (876)

Characterology. Various pseudoscientific schemes for explaining human traits and behavior. (5)

Chemotherapy. Use of drugs in the treatment of mental illness. (220)

Chlorpromazine. Sedative drug used in the treatment of mental disturbances; a "tranquillizer." (221)

Choroid coat. Middle layer of coating of the eye; rich in blood vessels. (236)

Chromosomes. Small bodies, found in pairs, which contain the genes, responsible for hereditary traits; half an individual's chromosomes come from the mother, half from the father. (33)

Clairvoyance. One kind of extrasensory perception, in which the subject supposedly becomes aware of an external object without the use of his sense organs, not established as a reality. (290)

Classical conditioning. See *Conditioning*.

Classification. Division of individual items into two or more categories on the basis of some variable; depending on the nature of the variable, classification may be either qualitative or quantitative. (18)

Client-centered therapy. A nondirective technique of psychotherapy developed chiefly by Carl Rogers; based on the theory that many individuals can work through their own problems by "talking them out" in a permissive and supportive atmosphere. (210)

Clinical method. A method of studying human behavior in which the life history of the individual is reconstructed on the basis of all available information, usually in an effort to discover the cause of some emotional or social maladjustment. Besides being a technique for gathering data, the clinical method also involves therapy designed to help the individual toward better adjustment. (24)

Cluster hypothesis. Hypothesis of color vision, according to which cones of a given type tend to be found in groups or clusters, each cluster sensitive to a particular wave length. (245)

Cochlear canals. Canals of the inner ear, containing fluid which is set in motion by vibrations of the oval window and which in turn stimulates the basilar membrane, causing it to excite the cells of the Organ of Corti and thus to set off impulses along the auditory nerve. (254)

Coded signal. A communication message as it passes over the channel. (376)

Coefficient of correlation (r). The exact mathematical correlation (average relationship) between two sets of scores; a perfect positive correlation has the numerical value of 1.00 and means that if the individuals were lined up according to one trait, they would also be lined up perfectly according to the other trait. (88)

Coefficient of determination (r^2). The square of the correlation coefficient; makes it possible to determine the extent to which variance in one trait can be explained by variance in another correlated trait. (90)

Cognitive processes. Knowing processes stressed by the field theorists, comprising all the means by which an individual represents objects and situations to himself or uses his representations as a guide to behavior. (320)

Color blindness. Visual defect in which the individual sees as identical hues which appear different to people with normal color vision. (249)

Color solid. Double cone which classifies colors three-dimensionally, with points along the vertical axis representing degrees of brightness, points along any radius representing degrees of saturation, and points around the circumference representing the different hues. (246-247)

Color wheel. Cross section of the color solid, used to show the relationship between hues. (240)

- Compensation.** Attempt to disguise the presence of a weak or undesirable trait by emphasizing a desirable one. (182) See also *Overcompensation*
- Complementary colors.** Two colors located opposite each other on the color wheel; complementary colors combine to give gray. (247)
- Complexity.** One of the physical characteristics of a light or sound wave; related to the psychological dimensions of saturation (light wave) and timbre (sound wave). (251)
- Compromise reaction.** A response to frustration in which the individual partially gives in to the frustrating obstacle but without entirely relinquishing his original goal; usually involves a lowering of one's level of aspiration or the acceptance of substitute goals. (181)
- Compulsion.** Bizarre action which the individual himself does not understand but nevertheless feels impelled to perform; usually symbolic in nature. (188)
- Concept.** Abstract idea derived from the grouping of objects in terms of some distinguishing common property. (352)
- Conditioned response.** A learned response to a stimulus not originally capable of arousing the response. (299)
- Conditioned stimulus.** A previously neutral stimulus which has become capable of evoking a particular (conditioned) response. (299)
- Conditioning.** A basic form of learning in which conditioned responses are established. In *classical conditioning*, a response comes to be evoked by a previously neutral stimulus when this stimulus is combined for a number of trials with the (unconditioned) stimulus which normally elicits the response. When the response is made to the new (conditioned) stimulus alone, it is said to be a conditioned response. In *instrumental conditioning*, no eliciting stimuli are presented; the subject is placed in an experimental situation where he learns to make an instrumental response leading to reward. (299-302)
- Cones.** Retinal receptor cells sensitive to both hue and brightness and responsible for color vision; effective only when eye is adapted to light. (237, 244)
- Conflict frustration.** The frustration of having to choose between two strong contradictory motives. (172)
- Conflicting attraction.** Form of conflict frustration in which the individual must choose between two desirable but mutually exclusive goals. (172)
- Conflicting avoidance.** Form of conflict frustration in which the individual cannot avoid one unpleasant alternative without encountering the other. (172)
- Conformity mechanisms.** Processes by which a group brings about a degree of conformity among its members. (548)
- Connectors.** Biological structures which connect receptors with organs of response; used primarily with reference to the nervous system, but also including the bloodstream and certain chemical substances such as hormones. (17)
- Consensus.** Process by which the members of a group discuss an issue until everyone is satisfied with the solution, rather than relying on a majority vote. (389)
- Continuous-adjustive movements.** Most complex type of control system for technological apparatus, in which the operator does not seek a set mark but must keep adjusting the controls to a changing situation, as in driving an automobile. (472-473)
- Control group.** Group of subjects in which the experimenter holds the independent variable under control either by keeping it constant or by removing it from the situation entirely (26) See also *Experimental control*.
- Controlled expression.** Method of controlling aggression by permitting the individual to discharge hostile emotional tensions into socially acceptable and often constructive channels (181)
- Convergence.** Process by which the eyes turn toward each other when focusing upon objects closer than about twenty feet so that both eyes fixate the same point in space. (239)
- Conversion reaction.** Neurotic reaction to stress in which psychological distress is converted into bodily symptoms, as in hysteria. (188)
- Cornea.** Transparent portion of the protective coat of the eye. (237)
- Correlating neurons.** Nerve cells with many short dendrites and axons, the latter often giving off branches called collaterals. (482, 485)
- Correlation.** See *Coefficient of correlation*.
- Correlation cluster.** A cluster of traits which go together, indicating the existence either of a single factor which incorporates these traits or of two or more factors operating together. (531)
- Cortex.** See *Cerebral cortex*.
- Cretinism.** Retarded development of the skeletal and nervous systems caused by thyroid deficiency during infancy or early childhood; often accompanied by low-grade intelligence. (48)
- Cross-sectional approach.** Method of studying the effects of age on various traits by grouping a large number of subjects according to their ages and using one set of tests for all. (114-115)
- Culture-fair test.** An intelligence test designed to minimize the effects of cultural factors by using items which would be equally comprehensible to those of all economic levels or nationalities. (105)
- Curve of diminishing returns.** Graphic presentation of a learning situation in which the greatest improvement in performance occurs during the early trials, the amount of improvement gradually decreasing thereafter; the most commonly obtained learning curve. (312)
- Curve of equal returns.** Graphic presentation of a learning situation in which early trials yield the same amount of improvement as later trials; essentially a straight line; usually indicates that the experimenter has obtained an incomplete picture of the learning process. (312)
- Curve of increasing returns.** Graphic presentation of a learning situation in which improvement is greater in later trials than in early trials; usually indicates that the full learning process has not been recorded. (312)
- Cutaneous senses.** Senses of pressure, pain, warmth, and cold. (257-259)
- Cybernetics.** Science of control and communication in the animal and machine. (368-369)
- Cyclical curve.** Learning curve which shows the oscillations which occur during learning by a group of subjects. (313-314)
- Cyclofusional movement.** Independent rotation of each eye about its axis so that light from an object strikes corresponding parts on the two retinas. (239)
- Cyclothymic.** Temperament characterized by fluctuations between gay and depressed moods; in Kretsch-

- men's theory, associated with the pyknic individual. (7)
- Dark adaptation. Process by which the eyes become more sensitive so that they can see under low illumination; usually requires about half an hour of darkness. (238)
- Daybook method. A form of the life-history method of obtaining data, usually employed in observing children; the individual's development is carefully observed and recorded day by day. (24)
- Decibel. Relative unit of measurement of the intensity of sound. (252)
- Defense mechanisms. Complex and varied behavioral devices which individuals employ in handling ego-involving frustrations; usually used unconsciously. (174)
- Delinquency. Legally prohibited behavior committed by minors. (405)
- Delirium tremens. Organic psychosis resulting from severe alcoholism, characterized by visual hallucinations. (200)
- Delusion. A strong belief opposed to reality which the individual steadfastly maintains in spite of logical persuasion and evidence to the contrary; symptom of psychosis. (200)
- Delusion of grandeur. Psychotic belief that one is an exalted personage. (200)
- Delusion of persecution. Psychotic belief that one is being plotted against and is in danger; characteristic of paranoid patients. (200)
- Delusion of reference. Psychotic belief that chance happenings and conversations are aimed at oneself. (200)
- Dendrites. Highly branched, usually quite short filers which occur at the receiving end of the neuron. (482)
- Dependent variable. In an experiment, the factor which the hypothesis predicts will change with changes in the independent variable. (26)
- Desensitization and redirection. Processes of eliminating undesirable emotional reactions and acquiring new adjustment skills during integrated psychotherapy. (229)
- Developmental task. Task imposed on the individual by maturation and cultural forces, examples are walking and talking. (60)
- Dichromatic color vision. Normal color vision for only yellow and blue; inability to distinguish red and green. (249)
- Dicrotic notch. A sharp but brief reduction in pulse pressure coming at approximately the end of the systolic phase of the heart beat. (153)
- Difference threshold. Smallest difference in stimulus intensity that a particular sense can detect; also known as the *just noticeable difference* (j.n.d.). (236) See also *Weber's law*.
- Dimension. A measurable trait. (66)
- Directive counseling. Least complicated type of psychotherapy, in which the therapist supplies direct answers to problems or uses such techniques as reassurance and suggestion. (210)
- Discrimination learning. Learning to distinguish between similar stimuli and to respond positively to one and negatively to the other. (305)
- Displaced aggression. Transfer of hostility from the object or person actually causing frustration to some other object or person or to the self. (178)
- Dissociative reactions. Neurotic reactions to extreme stress in which entire episodes of life are repressed from consciousness, as in amnesia, fugue, and multiple personality. (189)
- Distributed practice. Use of spaced learning periods. (331-332)
- Distribution curve. Graphic device showing the distribution of a set of measurements, or scores; if the distribution is a normal one, the curve will be bell-shaped. (84-85)
- Dizygotic twins. See *Fraternal twins*.
- Dream analysis. Technique in psychoanalysis by which the latent (or hidden) content of dreams is revealed. (214)
- Dream work. Unconscious process by which the emotionally painful latent content of a dream is transformed into the less painful manifest content which we remember. (214)
- Drive. Any internal stimulus condition which impels the organism to activity, often, but not necessarily, to goal-seeking behavior. (124)
- Ductless glands. Glands which secrete their substances directly into the bloodstream; also known as endocrine glands. (45)
- Dwarfism. Underdevelopment of the bones caused by a deficiency of the pituitary growth hormone early in life; results in adult of small and imperfectly proportioned stature. (46, 47)
- Eardrum. Thin membrane which separates the external ear from the middle ear; is made to vibrate by the pressure impulses of sound waves. (253)
- Ecclectic approach. In treating the mentally disturbed, stressing no particular procedure or theory but evaluating the contributions of all methods of therapy and using whatever seems appropriate to the needs of the patient; leads to integrated therapy. (229)
- Ectomorphy. Body type defined by Sheldon; characterized by fragility and linearity in body build and believed to have a cerebrotonic personality. (9)
- Effect, law of. A principle of the association theory of learning, according to which the connection which an organism forms between a stimulus situation and a response is strengthened when the response is followed by reward—i.e., by some satisfaction or need-reduction. (319)
- Effectors. The organs (muscles or glands) which perform the actual response functions of adjustment. (17)
- Efferent neuron. Neuron which carries messages from the central nervous system to an organ of response; also known as *motor neuron*. (485)
- Ego. In psychoanalytic theory, the rational aspect of the personality; regulates the impulses of the id in order to meet the demands of reality and maintain social approval and self-esteem. (213) More generally, the individual's concept of self. (58-59)
- Ego-involvement. Perception of a situation as potentially threatening or enhancing to one's self-concept. (178)
- Idiotic imagery. Mental imagery, usually visual, which is almost like actual perception in its clarity and accuracy; rare but most often found in children. (850)
- Electro-shock. Most widely used form of convulsive therapy for mental illness; electric current passed through the brain produces instant unconsciousness and convulsions. (219)

- Electroencephalograph (EEG).** Instrument for recording the minute electrical oscillations of the cerebral cortex known as brain potentials or brain waves. (154)
- Elicited behavior.** In conditioning, a response already in organism's repertoire which is initiated by some recognizable physical stimulus. (300)
- Embryology.** Study of the growth and development of embryos. (18)
- Embryonic period.** Period from the second through the eighth week of prenatal development, during which the embryo develops from a hollow sphere into a recognizably human form. (37)
- Emergency reaction.** The complex physiological activity which accompanies emotion; usually disappears relatively soon but if prolonged may cause psychosomatic disorders. (155) See also *General-adaptation-syndrome*.
- Emitted behavior.** Behavior which appears without the use of an external stimulus to initiate it; basis of instrumental conditioning. (300)
- Emotion.** Complex feeling state involving conscious experience, internal and overt physical responses, and power to motivate the organism to action. (145-146)
- Empathy.** Ability to understand and to some extent share the experience of another person's feelings. (150)
- Empirical.** Based on experience or experiment rather than theory. (218)
- Encephalization.** Tendency for the higher parts of the brain to take over the functions of the lower parts of the nervous system. (493)
- Encoding.** The operation of converting information into transmittable energy for the purpose of communication. (376)
- End brushes.** Group of tiny fibers at end of an axon; transmit impulses to the next neurons or directly to muscle or gland. (482)
- Endocrine glands.** See *Ductless glands*.
- Endocrines.** Hormones secreted by the ductless (endocrine) glands. (45)
- Endomorphy.** Body type defined by Sheldon; characterized by a tendency toward roundness and softness and believed to be associated with viscerotonic personality. (9)
- Engineering psychology.** See *Human engineering*.
- Environment.** All those factors, both physical and social, which act upon the organism from without; psychologists also use the term to include internal sources of stimulation. (15)
- Erg.** A new term applying to a unity of attitudes and interests that operate as a drive; examples of ergic patterns, identified by factor analysis, are sex, fear, curiosity, and gregariousness. (535)
- Ergic tension.** The strength of the "need" in any erg at a given time. (535)
- Estragens.** Female hormones produced by the ovaries; promote growth in the reproductive organs and other body parts important to child-bearing and motherhood. (50)
- Estrus.** Fertile period during which the female animal becomes highly receptive to the male; sometimes referred to as "heat." (135)
- Ethnic group.** Group of people who, on the basis of one or two identifying characteristics, are treated socially as though they constitute a special group; sometimes confused with "race." (416)
- Eustachian tube.** Tube leading from the middle ear to the throat; provides for the maintenance of equal air pressure on both sides of the eardrum. (254)
- Experimental control.** In the experimental method, process of holding constant all variables but one which might affect the experiment's outcome. (26)
- Experimental design.** A formal statement which defines the experimental problem, states the conditions under which the observations are to be made, and outlines the procedures to be followed in evaluating the results. (25)
- Experimental extinction.** Gradual disappearance of a conditioned response when the conditioned stimulus is repeated without being reinforced by the unconditioned stimulus. (299-300)
- Experimental group.** Group of subjects with whom the experimenter alters the independent variable whose influence he wishes to study; the effects of the independent variable are determined by afterwards comparing the experimental group with the control group. (26)
- Experimental method.** The most highly formalized scientific method, in which hypotheses are tested under precisely controlled conditions. (25-27)
- Extirpation method.** Method of studying brain functions in animals by systematically destroying part of the brain and observing how the animal's behavior changes. (486)
- Extrasensory perception (E.S.P.).** Becoming aware of objects or ideas without use of the sense organs; comprises the phenomena of mental telepathy and clairvoyance; not definitely established as a reality. (260)
- Extrinsic motivation.** The use of motives which are capable of motivating the subject to action but which have no inherent relationship to the task to be learned. (326)
- Factors.** Functional unities which contribute to a complex ability, trait, or form of behavior. (73, 531) See also *Correlation cluster*.
- Factor analysis.** The statistical technique of identifying and measuring the relative importance of the underlying variables, or factors, which contribute to a complex ability, trait, or form of behavior. (28, 73)
- Fantasy.** Withdrawal reaction in which the individual escapes from frustration through daydreaming; wish fulfillment may also take place in night dreams. (174-175)
- Feeble-minded.** See *Mental defective*.
- Feedback.** Error-correcting information returned to the control center of a servomechanism (or to the nervous system and brain of a living organism), enabling it to offset deviations in its course toward a particular goal. (331, 369) Also, the interchange of information on the part of human beings in a communication or problem-solving situation. (376-377)
- Fetal period.** Prenatal period from the eighth week after conception until birth. (37)
- Fetus.** The unborn human organism from the eighth week after conception until birth. (37)
- Field properties.** See *Field theory*.
- Field study method.** Research technique in which the investigator observes the subjects under their usual environmental conditions without attempting to control the conditions and often without the subjects' knowledge that they are being observed. (23)

Field theory. Theory that the organism exists in an environmental field which is constantly changing, so that the field forces operating on him must be taken into account in any attempt to predict his behavior; also maintains that all experience has field properties which make the total experience greater than the sum of its parts. As a learning theory, maintains that learning is the organization or reorganization of the subject's perceptual systems into meaningful patterns. (319-320)

Figure and ground. Organization of the visually perceived whole, the figure being the part of the pattern most clearly perceived at a given moment, while the rest of the perceptual field becomes ground. (273)

Fissure of Rolando. Deep, nearly vertical furrow or groove on the side of each hemisphere, separating the frontal and parietal lobes; also known as the central sulcus. (489)

Fissure of Sylvius. Deep horizontal groove on the lateral surface of each cerebral hemisphere, separating the temporal from the frontal and parietal lobes; also known as the lateral fissure. (489)

Force. Authoritarian type of leadership relying upon fear for its effectiveness. (385)

Forced-choice method. Method of controlling faking on self-inventories and other rating devices; from each group of characteristics of equal desirability, the subject chooses the characteristic which he thinks is most or least like himself (or whomever he is rating). (457-458)

Fore-period. Time elapsing between a warning signal and an expected stimulus. (293)

Form board. A board with recesses into which the subject must fit blocks of the proper size and shape as quickly as he can; used as a performance test to measure intelligence. (71)

Fovea. Area in center of retina with greatest density of cones and complete absence of rods; area of clearest daytime vision. (237-238)

Fraternal twins. Twins which, unlike identical twins, develop from two separate fertilized eggs (zygotes) and do not resemble each other any more closely than other brothers and sisters. Also called dizygotic twins. (34)

Free association. Principal procedure used in psychoanalysis to probe the unconscious; patient lets his mind wander freely, giving a running account of every thought and feeling. (213-214)

"Free-floating" anger. Chronic reaction pattern in which hostility becomes generalized so that even neutral situations are reacted to with hostility. (179)

Frequency. One of the physical characteristics of a light or sound wave; related to the psychological dimensions of hue (light) and pitch (sound). (251)

Frequency theory. See *Telephone theory*.

Frontal lobe. Portion of each half of the cerebrum, located in front of the fissure of Rolando and above the fissure of Sylvius. (489)

Frustration. Denial or thwarting of motives by obstacles which lie between needs and goals; may be environmental, personal, or the result of conflict. (171)

Fugue. Loss of memory accompanied by actual physical flight. (190)

Functional connections. Neural pathways which actually participate in the transmission of a nerve impulse between receptor and effector. (44)

Functional fixedness. Inability to see a new use for a familiar tool. (362)

Functional psychosis. Severe mental disorder precipitated primarily by psychological stress. (197)

Functionalists. School of psychology which emphasized the study of man's adjustment to his environment. (11-12)

Galvanic skin response. Increase in voltage and/or change in electrical resistance of the skin occurring during emotion as a result of action of the autonomic nervous system on the sweat glands. (152)

Gamete. Male or female germ cell; gametes are unique in that they contain only half the number of chromosomes found in the other cells of the body. (33)

Ganglion (pl. ganglia). A collection of nerve cells and synapses. (500)

Gene mutation. A sudden change in the chemical structure of a gene, expressed in the appearance of a new trait. (414)

General-adaptation-syndrome. The body's reaction under continued stress, consisting of the *alarm reaction*, during which the body makes a number of complicated physiological changes in response to a stressor; the *stage of resistance*, during which the organism, with the aid of increased secretions of the anterior pituitary and the adrenal cortex, is able to withstand the stressor for a time without showing symptoms; and the *stage of exhaustion*, in which the organism can no longer resist the stressor and may die if stress does not cease. (157-158)

General intelligence. See *Global intelligence* and *Intelligence*.

Genes. Ultramicroscopic areas within the chromosomes; the real bearers of heredity. (33)

Genetics. The study of hereditary processes. (18)

Germinal period. The first two weeks of prenatal development, during which the zygote develops by division into a hollow sphere of cells. (36-37)

Gestalt psychology. A school of psychology which teaches that psychology should study the whole pattern of behavior instead of trying to understand it by studying its elements, since the whole is more than the sum of its parts. (12)

Gigantism. Overgrowth of the skeletal structure caused by oversecretion of the pituitary growth hormone early in life. (46-47)

Glittering generalities. Persuasive device which employs vague, high-sounding but exaggerated terms to describe persons or objects. (437)

Global intelligence. Concept, developed by Wechsler and used as the basis of his intelligence tests, that general intelligence is not just pure intellectual ability but involves the personality as a whole. (73)

Goal. Substance, object, or situation which is capable of satisfying a need and toward which motivated behavior is directed; achievement of the goal (sometimes called a reward or incentive) completes the motivated act. (123)

Gonads. The sex glands (testes in the male and ovaries in the female); produce gametes and also secrete hormones which influence bodily development and behavior. (48-49)

Group-centered leadership. A slightly modified form of group dynamics which emphasizes the leader's role in making the most of the abilities of each member and hence helping the group achieve its potential. (383-384)

- Group dynamics.** The analysis of group relations, based on the principle that group behavior is the result of dynamic interaction between individuals in a social situation. (381-382)
- Group therapy.** Form of psychotherapy in which a group of persons discuss their problems under the guidance of a therapist; usually nondirective in character. (224-225)
- Group-to-group relations.** That area of psychology which deals with the problems involved in the interaction of groups. (14)
- Habit.** Used by psychologists to refer to all products of learning, including impressions which result from only one experience and transitory modes of response. (298)
- Hallucination.** Sensory impression of external objects in the absence of any appropriate stimulus in the environment; a symptom of psychotic behavior. (109)
- Halo effect.** Tendency, when rating an individual on a particular trait, to be influenced by one's opinion of some other trait or by the individual's personality as a whole. (76)
- Hammer.** The first of three hinged bones in the ear (the others being the anvil and stirrup) which together transmit vibrations from the eardrum to the oval window. (254)
- Harmonics.** See *Overtones*
- Hemianopia.** Blindness in the same side of each retina caused by damage to one occipital cortex. (492)
- Hippocampus.** Cortical area identified with olfactory sensitivity; located beneath the temporal lobe. (493)
- Homeostasis.** The complex process of maintaining stability in the internal and external environment so that the body's chemical balance can be maintained and personality needs can be satisfied; homeostasis on the physiological level is largely automatic. (125-126, 142)
- Hormones.** Secretions of the ductless gland; also known as endocrines. (17, 45)
- Hue.** Quality of color sensation determined by the frequency or wave length of the light waves. (245)
- Human engineering.** Planning of work space and equipment in accordance with the sensory capacities, strength, and body dimensions of the worker, so as to bring about maximum efficiency while maintaining maximum safety and comfort of the operator; also called engineering psychology. (470)
- Humoral theory.** Oldest known characterological theory, developed by the Greek Hippocrates, which stated that human nature could be ascribed to the four "humors" or fluids of the body—blood, black bile, yellow bile, and phlegm. (5)
- Hyperalgesia.** Exceptional sensitivity, causing pain to be experienced in response to any mild stimulus. (256)
- Hyperopia.** Far-sightedness, caused by the lens being unable to bulge out enough for close vision; image comes into focus behind the retina. (243)
- Hypnosis.** Artificially induced state of extreme suggestibility; used in psychotherapy primarily as an aid in uncovering repressed or forgotten early experiences. (226)
- Hypnotic regression.** Process by which a subject vividly relives, under hypnosis, experiences which he has forgotten or repressed. (227)
- Hypnotic suggestion.** See *Posthypnotic suggestion*.
- Hypochondria.** Nervotic preoccupation with the body's activities and the state of one's health. (189)
- Hypothalamus.** Key structure in diencephalon at base of brain; important in temperature regulation, emotion, motivation, and other activities. (127-128, 503)
- Hypothesis.** Statement or proposition, usually based on the results of previous observations, which is tested in an experiment; it may be denied or supported by experimental results but never conclusively proved. (25-26)
- Hysteria.** Appearance of physical symptoms that have no organic basis; a conversion reaction to stress, in which psychological distress is converted into bodily disturbances. (188-189)
- Id.** In psychoanalytic theory, the primitive part of the unconscious, composed of instinctive organic cravings and characterized by unrestrained pleasure-seeking impulses. (213)
- Idential learning.** Learning of relatively complex meaningful material, in which grasp of the subject matter rather than verbatim learning is required. (333)
- Identical twins.** Twins which develop from a single fertilized egg; also called *monozygotic twins*. (34)
- Identification.** Defense mechanism by which the frustrated individual incorporates into his own personality structure the qualities of those who potentially threaten him; also a constructive process by which children model themselves upon parents or other adults with whom they identify. (176-180)
- Idiot.** Classification of severe mental defective with I.Q. of 25 or less; idiots require care by another person. (95)
- Illusion.** False perception. (266)
- Imbecile.** Classification of severe mental defective with I.Q. between 20 and 50; imbeciles may learn to do simple work but usually must live under close supervision. (95-96)
- Implicit speech.** Tiny muscular contractions, in the speech mechanism and elsewhere, which occur during thought. (355)
- Independent variable.** Factor whose effects are being examined in an experiment; it is allowed to change in some systematic or predetermined manner while the other variables are held constant. (36)
- Individuation.** Pattern of development from general to specific, characteristic of the maturation process. (36)
- Information theory.** The principles that make for understanding, control, and predictability in communication. (375)
- Input.** In cybernetics, the stimuli which initiate the activity of a machine or organism. (369)
- Insanity.** A legal concept applied to any mental condition which renders the individual incapable of intent and legally irresponsible for his actions. (196)
- Insight.** In learning, the apparently sudden appearance of the solution to a problem. (308-309) In psychotherapy, the understanding of one's own behavior, motives, feelings, and attitudes. (216)
- Instinct.** Behavior pattern whose underlying biological pattern is produced by maturation rather than learning and which appears full-blown upon the first occasion that an adequate stimulus is presented, without the organism's having previous opportunity

- to learn; common in lower animals but very rare in man. (51)
- Institutional advertising.** A form of propaganda designed to create a favorable attitude toward a particular company, an entire industry, or business in general; employed primarily by large corporations. (440)
- Instrumental conditioning.** See *Conditioning*.
- Insulin.** Hormone secreted by the pancreas; helps the body to metabolize sugar. (45)
- Insulin shock.** Treatment of mental disturbance by administration of insulin to produce a period of coma followed by a lucid period which can be used for psychotherapy. (218)
- Integrated therapy.** See *Eclectic approach*.
- Intellectualization.** A compromise defensive reaction in which the individual attempts to divest his problems of painful feelings by pushing them into the realm of the intellect through rationalization, isolation, or undoing. (182-183)
- Intelligence.** Complex mental ability; composed of a number of primary abilities including verbal comprehension, space visualization, reasoning ability, numerical ability, and others, operationally defined, intelligence is that which intelligence tests measure. (73-74)
- Intelligence quotient (I.Q.).** Measure of intelligence obtained by dividing the individual's mental age (M.A.), as determined by his performance on standardized test items, by his chronological age (C.A.) and then multiplying by 100. An I.Q. of 100 is considered to be average. (70, 93-94)
- Intensity.** One of the physical characteristics of a light or sound wave; related to the psychological dimensions of brightness (light wave) and loudness (sound wave); also known as amplitude. (251)
- Interest.** A pleasurable feeling that accompanies some activity in progress; directly related to the need for self-enhancement. (141)
- Interneurons.** Correlation neurons linking the sensory and motor neurons of a sensory-motor arc. (485)
- Intervening variable.** A logical construct to account for a process intervening between the variables controlled by the experimenter and the observed changes which take place in the dependent variable; this term is ordinarily applied only to logical constructs which are quantitative in nature or at least constant in form. (27)
- Intrapersonal relations.** Psychological activities that occur within the individual himself. (14)
- Intrinsic motivation.** Motivation to work for rewards which are inherently related to the matter to be learned. (326)
- Introjection.** Type of identification in which the individual incorporates into his own personality the characteristics of people whom he fears, as a means of reducing their threat to him. (180)
- Introspection.** Technique of observing conscious processes and states, such as thinking and emotion, which go on within oneself. (21)
- Iris.** Colored portion of the eye immediately surrounding the pupil. (287)
- Irradiation.** Process by which fibers respond and muscles are activated over a wider area when the strength of the reflex stimulus is increased. (487)
- Isolation.** Avoidance of conflict between two opposed desires or attitudes by keeping them apart in "logic-tight compartments" in consciousness. (183)
- Jensen Grid Test.** Measure of visual acuity which uses lines pointing at various angles; minimizes possible cheating and can be used with illiterates. (241)
- Jump movements.** Series of short movements made by the eye in looking at motionless objects. (230)
- Kahn Test of Symbol Arrangement.** Projective test in which the subject projects personal needs onto culturally structured symbols, such as the heart and the anchor, by arranging them and telling what they mean to him. (82)
- Kinesthetic sense.** Sense of active movement, muscular sense. (259)
- Labyrinth.** Inner ear, contains cochlea and semicircular canals. (260)
- Labyrinthine sense.** Sense of passive movement, located in the semicircular canals of the inner ear. (260)
- Latent content.** Actual motives which are seeking expression in a dream but which are so painful that we do not want to recognize their existence; disguised in the manifest content of the dream. (214)
- Lateral fissure.** See *Fissure of Sylvius*.
- Learning.** Process which brings about a change in the individual's behavior as a result of practice or other experience; can only be inferred from performance. (297)
- Learning curve.** Graphic device for showing the amount or quality of a subject's performance after successive units of practice. (310-311)
- Lens.** Structure of the eye which focuses the light rays onto the sensitive retina. (237)
- Leptosome.** Tall and thin body type of Kretschmer's theory, associated with a schizothymic temperament. (7)
- Lesion.** Destruction of a portion of the brain by experiment or accident. (480)
- Libido.** In Freudian theory, the instinctive pleasure-seeking drive which is the source of energy underlying all human behavior. (213)
- Life-history method.** Technique of psychological observation in which the development of particular forms of behavior is traced; includes the daybook method, clinical method, and biographical method. (24)
- Limen.** Threshold; transitional point at which a stimulus becomes strong enough to produce a conscious response. (235)
- Linear perspective.** Phenomenon of objects appearing both smaller and closer together as they become more distant. (283)
- Links.** All connections necessary to the performance of a task including those between men and machines, men and men, and machines and machines, may be visual links, talking links, walking links, or control links; basis of equipment arrangement in human engineering. (470)
- Logic-tight compartments.** Form of intellectualization in which opposing desires or attitudes are "sealed off" in separate areas of consciousness; isolation. (183)
- Logical construct.** Quality, substance, or event whose existence is postulated by the experimenter to aid in explaining how the independent variable operates on the dependent variable; sometimes called a hypothetical construct. (27) See also *Intervening variable*.

Long-conducting neurons. Nerve cells with long, single axons or long dendrites, all sensory and motor fibers are of this type. (482)

Longitudinal method. Method of studying effects of age on various traits or abilities by testing and retesting the same individuals over a period of time. (116)

Loudness. Volume or intensity of sound, determined by the amplitude of the sound wave; expressed in decibels. (251, 252)

Lysergic acid diethylamide (LSD). Drug capable of bringing on symptoms of mental disease in normal individuals; used in mental therapy. (198)

Make a Picture Story Test (MATS). Projective technique in which the subject is presented with a series of backdrops, for each of which he selects characters from a group of cutout figures and tells a story. (82)

Manic-depressive reactions. Psychotic reactions characterized by alternation between periods of extreme elation and periods of extreme depression. (201)

Manifest content. The surface content of a dream. (214) See also *Latent content*.

Market research. Motivational research designed to determine the buying habits and needs of people and their attitudes and reactions toward various products. (520)

Mass action. Sluggish, irregular, widespread movement characteristic of the spontaneous movements of the fetus. (87)

Massed practice. Use of concentrated learning periods. (332)

Maturation. Process of development and bodily change resulting from heredity acting over a period of time; independent of learning but may be hampered by a subnormal environment. (32)

Mean. See *Arithmetic mean*.

Measures of central tendency. Measures of typical or representative values of a set of data, used in determining a point of origin; those used most often are the mean, median, and mode. (86)

Measures of confidence. Measures of the probability that the results of an experiment could have been obtained by chance alone; for example, if the result is significant at the one per cent level of confidence, it means that the result could have been obtained only once in a hundred times by chance alone. (80-81)

Measures of deviation. Measures of variability or spread; often used as means of determining how far above or below the average of his fellows an individual is in a given trait; the most common measures of deviation are standard scores. (86-87)

Mechanization. Rigid continuation of behavior which has been successful previously but which is inappropriate to the present situation. (361)

Median. The middle score of a sample, separating the upper half of the cases from the lower half; a measure of central tendency. (86)

Medulla. Upper, thickened extension of the spinal cord; part of the brain stem, most primitive part of brain. Full name, *medulla oblongata*. (481)

Memory drum. Instrument used in experiments on verbal learning. (308)

Memory span. Amount of material which can be mastered from a single presentation; usually about six to eight digits or letters presented orally. (320)

Menarche. The stage of female development at which menstruation first occurs, usually between the ages of 12 and 14. (50)

Mental age (M.A.). An individual's degree of mental development as measured by standardized intelligence tests, based on the scores made by average children of a given age; thus, a five-year-old who scored as well as average seven-year-olds would be assigned a mental age of 7. The concept of M.A. was developed by Binet and is used in determining the intelligence quotient. (69)

Mental defective. Individual who, because of low intelligence, is to some degree ineffective in handling his own affairs. Those with I.Q.'s below 50 are classified as severely deficient, between 50 and 70 as moderately deficient; and between 70 and 85 as mildly deficient. (95-97) See also *Idiot*, *Imbecile*, and *Moron*.

Mental health movement. Movement started by Clifford Beers shortly after 1900 which seeks to create public awareness of the importance of psychological prophylaxis in the prevention of mental illness and of psychotherapy as a method of treating mental illness. (205)

Mental health team. Psychiatric personnel who work together on helping a client work out a solution to his adjustment problems; typically composed of a psychiatrist, psychiatric nurse, clinical psychologist, and psychiatric social worker. (511)

Mental telepathy. The alleged passage of awareness from one mind to another without intervention of the sense organs. (290) See also *Extrasensory perception*.

Mescaline. Drug capable of bringing on symptoms of mental disease in normal individuals, used in mental therapy. (198)

Mesmerism. Teaching of Mesmer in the late eighteenth century that illness could be cured by passing steel rods over the body to restore the balance of the "magnetic fluid" within; a forerunner of hypnotism. (9)

Mesomorphy. Body type defined by Sheldon, characterized by predominance of muscle and bone and believed to have a somatotomic personality. (9)

Metabolism. Chemical changes taking place in all living tissues by which energy is provided to carry on the life processes. (45)

Metrazol. Drug used for shock therapy, producing violent convulsions; seldom used today. (218)

Midline functions. Body functions such as speech which are located in the midline of the body; controlled by the left side of the brain in normal right-handed persons. (497)

Mode. Score earned by the greatest number of members of the group being studied; a measure of central tendency. (86)

Modes of appearance. Characteristics of visual sensations other than those of hue, brightness, and saturation; include such sensations as glow, luster, and bulk. (248)

Monozygotic twins. See *Identical twins*.

Mood. An emotional state that is drawn out over a period of hours or days and is usually less intense than an "emotional outburst" such as anger. (146-147)

Moron. Classification of moderate mental defective with I.Q. from 51 to 70; morons can usually learn to read and write and to perform routine jobs. (96)

Morphology. Form and structure of the organism as a whole. (7)

Motivational research. Qualitative advertising research concerned with determining the underlying, un verbalized motives which operate to cause people to buy certain products. (443)

Motive. Internal condition which serves to direct the organism toward a certain goal. (123)

Motor aphasia. Loss of ability to use spoken language although the larynx is not paralyzed, caused by lesions in the association areas of the cerebral cortex. (496)

Motor area. Cortex immediately in front of the fissure of Rolando; controls motor functions. (491)

Motor neuron. See *Efferent neuron*.

Motor primacy. The principle that the neuromuscular structures of the body must reach a certain stage of development (maturation) before they are capable of responding to stimulation. (36)

Multiple personality. Extreme dissociative reaction in which the individual develops two or more distinct personalities which alternate in consciousness, each personality being based on sets of motives which are in conflict with those of the other personality or personalities. (191)

Mutual means. Most difficult and most democratic type of leadership; leader creates a situation in which his own activities and those of the group members serve as mutual means of gaining satisfaction for everyone concerned. (385-386)

Myelin sheath. Fatty white covering which surrounds the axons and collaterals of large diameter in the nervous system. (482)

Myelination. Process by which certain nerve axons become surrounded by the myelin sheath; necessary before they can function. (482)

Myopia. Near-sightedness, caused by the lens bulging out too far so that the image comes into focus slightly in front of the retina and appears fuzzy. (243)

Name calling. Persuasive device in which neutral objects or persons are made acceptable or unacceptable by being given pleasant or unpleasant names. (436)

Narcosis. Brief form of narcosis in which sleep-producing drugs are administered in amounts sufficient to cause a state of "twilight sleep" rather than deep unconsciousness; while in this state patient is encouraged to talk about emotionally painful experiences. (219)

Narcosis. Technique of therapy which uses sleep-producing drugs; in prolonged narcosis, now used only for severely agitated patients, the patient may be kept asleep for fifteen or more hours a day for one or two weeks. (219)

Negative afterensation. Perception of a complementary hue after original stimulation ceases. (245)

Negative transfer. Interference of a prior learning task with the learning and recall of a new task; also known as proactive inhibition. (335)

Negativism. Tendency to want forbidden things and to be averse to things for which one is praised; usually caused by too many or too rigid demands early in life. (140)

Neonate. Newborn infant. (39)

Nerve. See *Nerve trunk*.

Nerve impulse. Electro-chemical excitation propagated along a chain of nerve cells. (479)

Nerve nets. In cybernetics, the postulated ultramicro-

scopic interconnecting communication channels along which nervous impulses travel during thought. "Superhuman" nerve nets, so called because they are superior to those of man in speed and accuracy, are involved in giant computing machines. (370)

Nerve tract. Nerve pathway composed of neurons carrying impulses to and from the brain. (480)

Nerve trunk. Bundle made up of the long extensions of numerous neurons; may contain both sensory and motor fibers. (179)

Neural patterns. Series of connections between receptors and organs of response; underlie all behavior patterns. (17)

Neuroasthenia. Neurotic conversion reaction in which the individual feels tired all the time and suffers from mild physical symptoms. (189)

Neurologist. Medical doctor who specializes in disorders of the brain and nervous system; often treats mental illness of organic origin. (209)

Neurology. The specialized study of the brain and nervous system and disorders thereof. (13)

Neuron. Individual nerve cell. (479)

Neurosis. Abnormal reaction pattern which lowers efficiency but seldom requires hospitalization, the neurotic individual usually retains contact with reality. (184)

New brain. See *Cerebrum*. (481)

Nomadism. Withdrawal reaction in which the individual continually moves from place to place or job to job in an attempt to get away from frustrating situations. (175)

Noncommitment. Attempt of the neurotic to evade the conflict between his urge toward growth and his basic feeling of inadequacy by never committing himself wholeheartedly to a belief or an activity. (186)

Nondirective therapy. See *Client-centered therapy*.

Noradrenaline. Hormone secreted by the adrenal medulla during emotion; brings about a number of bodily changes, including constriction of the blood vessels near the body's surface. (48, 151)

Normal distribution curve. Bell-shaped curve showing how traits are normally distributed throughout the population; the greatest number of cases are concentrated around the middle, with the number tapering off toward both the upper and the lower extremes. (84-85)

Norms. Standards derived from testing a large group of persons and used for comparing an individual's score with the scores of others in a defined group; often presented through tables which tell how many persons' scores in the standardization group a particular score equals or exceeds. (67)

Objective observation. Technique by which the experimenter observes overt behavior and the conditions under which such behavior occurs. (21)

Objectivity. In a test, the degree to which two or more persons can score a subject's responses and get the same results; one criterion of a good measuring instrument. (67)

Obsession. Persistent and irrational idea, usually unpleasant, that comes into consciousness and cannot be banished voluntarily. (187)

Obsessive-compulsive reactions. Abnormal reaction patterns characterized by the presence of persistent irrational ideas and/or bizarre actions. (187)

Occipital lobe. Portion of the cerebrum located at the back of the brain; location of the visual center. (489)

Occupational therapy. The use of constructive work, especially handicrafts, in the rehabilitation of patients with emotional or physical disorders. (230)

Old brain. Part of the brain consisting of the cerebellum, pons and medulla, thalamus, and hypothalamus; so called because it developed early in the course of evolution. (481)

Olfactory sense. Sense of smell. (235)

Operational definition. A definition of an abstract concept, such as "intelligence" or "hunger," framed in terms of observable events or operations; aids an experimenter in making accurate and precise observations. (23)

Opinion poll. Survey in which the investigator samples the opinion of the general public or some particular segment of it on particular issues; one means of measuring the effects of mass communication. (25, 444)

Optic nerve. Nerve which carries impulses from the retina to the brain. (237)

Organ of Corti. Thickening of the basilar membrane at the floor of the cochlear duct; contains hair cells which are stimulated by motion of the fluid in the cochlear canals; impulses pass from nerve fibers associated with the hair cells to the auditory nerve and hence to the brain. (254)

Organic psychosis. Mental disorder resulting from an irreversible injury to the nervous system or from certain reversible conditions such as glandular deficiency. (198-197)

Organism. Biological structure composed of a group of organs which work together to carry on life activities. (15)

Organs of adjustment. Organs (such as the nervous system, certain glands, the skeleton, and the muscles) which function to help the individual adjust to his environment and overcome obstacles to the satisfaction of his needs. (16)

Organs of maintenance. Organs (such as the stomach, alimentary canal, lungs, and digestive glands) which function internally to maintain the individual's health and growth. (16)

Ortho-rater. Instrument for measuring visual acuity; subject views slides and is asked to identify the location of a black and white checkerboard in various positions. (242)

Output. In cybernetics, the responses of a mechanism or organism. (369)

Oval window. Membrane separating the middle from the inner ear; receives vibration from the hammer, anvil, and stirrup bones and in turn forces movement of the fluid in the cochlear canals. (254)

Overcompensation. Extreme or socially unacceptable attempt to counterbalance actual or felt inferiority. (182)

Overtones. The fainter sounds produced by the vibration of fractions of a vibrating wire or reed in a musical instrument and heard along with the fundamental tone; give a distinctive timbre to the sound of each different instrument; also called partials or harmonics. (253)

Ovulation. The release of a mature egg cell from an ovary into the oviduct (egg conductor) and thence into the uterus. (185)

Ovum. Female gamete or germ cell. (32-33)

Paired associate learning. Verbatim learning in which the subject must learn to anticipate the second member of each of several pairs of words or syllables when the first member appears. (303)

Paradoxical cold. Sensation of cold aroused by a warm object, obtained when cold-sensitive spots are stimulated by objects with a temperature above 110 degrees Fahrenheit. (259)

Paradoxical warmth. Sensation of warmth aroused by a "cool" object (with temperature below the psychological zero point); obtained when warmth-sensitive spots are stimulated by objects with temperatures from about 75 to 88 degrees Fahrenheit. (259)

Paraphasia. Use of the wrong word or some meaningless symbol when writing; caused by lesions in the association areas of the cortex. (496)

Paranoia. Psychosis characterized by delusions of persecution, often accompanied by delusions of grandeur. (200)

Paraphasia. Use of the wrong word in speech; caused by lesions in the association areas of the cerebral cortex. (496)

Parasympathetic division. Division of the autonomic nervous system which controls most of the ordinary vital functions of life, such as digestion; its action is antithetic to that of the sympathetic division in most cases. (481, 500-501)

Parietal lobe. Portion of the cerebrum above the fissure of Sylvius and back of the fissure of Rolando. (489)

Partials. See *Overtones*.

Paternalism. Type of leadership in which the leader tries to satisfy the needs of his followers, hoping thus to gain their loyalty. (385)

Perception. Process of becoming aware of objects, events, and qualities that stimulate the sense organs, and of determining the relationships among them. (265)

Perceptual defense. Phenomenon by which words or objects connected with cultural taboos are perceived less readily than neutral or pleasant ones. (280)

Performance curve. See *Learning curve*.

Performance test. Test in which muscular reactions are substituted for verbal reactions. (70-71)

Peripheral nervous system. Nerve fibers passing from the receptors to the central nervous system or from the central nervous system to muscles and glands. (480)

Person-to-group relations. Area of psychology which deals with the ways in which individuals adjust to the groups of which they form a part. (14)

Person-to-object relations. Area of psychology which deals with the interaction between the individual and the objects in his physical environment. (14)

Person-to-person relations. Area of psychology which deals with the ways in which individuals affect each other. (13-14)

Personality. The whole person, including his external appearance and behavior, his inner awareness of "self" as a permanent organizing force in his life, and his particular pattern of measurable traits. (65)

Phobia. Irrational fear resulting from the displacement of fear onto some environmental object or situation other than the original cause of the fear. (180)

Phrenology. Pseudoscientific doctrine that personality is composed of a specific number of "faculties," each located in a specific area of the brain and identifiable by bumps on the skull. (6)

- Physiological gradient.** A line of decreasing intensity of reaction to stimulation, lying along the central vertical axis of the organism, with reaction being greatest at the head. Maturation follows the physiological gradient, proceeding from the head to the feet and from the center outward. (36)
- ✓ **Physiological limit.** Point beyond which further practice brings no further improvement in performance of a motor task. (315)
- Physiology.** Study of the functions of living organs and their parts. (13)
- Picture completion test.** Performance test in which the subject looks at an incomplete picture and decides which of several parts will fill in the blanks to make the most sensible whole picture; used in measuring intelligence. (71)
- Pitch.** Quality of sound produced by the frequency of the sound wave; expressed in cycles per second. (251-252)
- Pituitary gland.** The most important endocrine gland associated directly with growth; located in the center of the head on the underside of the brain; secretes pituitary growth hormone, which controls normal growth in childhood, and a number of "middle man" hormones which act directly upon other endocrine glands. (46-47)
- Place theory.** See *Resonance theory* and *Valley theory*.
- Placenta.** Organ which develops during prenatal period to provide nourishment for the embryo and to take care of its waste products. (37)
- Plain folks.** Persuasive device by which people are influenced toward a certain line of action because it is identified with the "common man." (438)
- ✓ **Plateau.** Period of no apparent learning, as measured by performance; appears as a flat place on a learning curve. (313)
- Play therapy.** Form of psychotherapy in which the patient expresses his repressed frustrations through such play activities as painting, modeling clay, or manipulating families of dolls; used primarily with children. (225)
- Point of origin.** Point used as a basis of comparing test scores, much as the zero point is used on the temperature scale; in psychology, a measure of central tendency usually serves this purpose. (84)
- Pons.** Broad and protruding part of brain stem just above medulla. (481)
- Positive after sensations.** Sensation of the original hue after stimulation ceases. (248)
- Positive transfer.** The more ready learning of a new task because of prior learning of another task; also known as proactive facilitation. (335)
- Posthypnotic suggestion.** Suggestion, made by the operator during hypnosis, which becomes or remains active after the hypnotic session is over; usually effective only for a few days. (226-227)
- Power test.** Test in which the subject is allowed practically unlimited time; his score expresses the degree of difficulty of the tasks he is able to accomplish. (68)
- Prefrontal lobotomy.** Form of psychosurgery in which the nerve fibers connecting the hypothalamus with the prefrontal lobes of the brain are severed, the purpose being to cut intellectual processes off from the emotional processes which normally accompany them; used only on the most severe mental cases when all other forms of therapy have failed to bring improvement. (222)
- Prejudice.** An emotionally toned prejudgment for or against a person or group of persons; as most typically used, an unfavorable and often hostile attitude toward the members of an ethnic group. (417)
- Prenatal period.** The entire term between conception and birth, normally about 40 weeks. (37)
- Pre-positioning.** In human engineering, the placing of tools as nearly as possible in the location where they will be used and at the proper angle to be grasped most easily. (470)
- Prepotency.** The inherent effectiveness of certain kinds of stimuli in attracting attention. (268)
- Presbyopia.** Condition of far-sightedness caused by a hardening of the lens which occurs with age. (243)
- Primary colors.** Colors which cannot be derived from any other colors but can, when mixed in different proportions, produce all other colors. The primary colors of light mixture are red, green, and blue; those for pigment are red, yellow, and blue. (247)
See also *Psychological primaries*.
- Primary mental abilities.** The relatively independent abilities, identified through factor analysis, which make up "general intelligence." Among them are verbal, spatial, numerical, and reasoning abilities, perceptual speed, and rote memory. (73-74)
- Privileged communication.** Freedom from being required to report to the authorities any information revealed by a client or patient concerning legal guilt; enjoyed by lawyers, clergymen, and in some states by physicians; a right which clinical psychologists are working to obtain. (209)
- Proactive facilitation.** See *Positive transfer*.
- Proactive inhibition.** See *Negative transfer*.
- Progesterin.** Female hormone secreted by the ovaries; produces changes in uterus tissues so that they can support fetal life. (50)
- Projection.** Defense mechanism by which the individual unconsciously convinces himself that others have the undesirable thoughts and motives which he actually has himself. (180)
- Projective techniques.** Methods of measuring personality traits in which the subject is presented with a standardized set of ambiguous or neutral stimuli and is allowed to interpret freely what he sees in them; also called depth techniques; examples are the Rorschach Test and the Thematic Apperception Test. (77-78)
- Prophylaxis.** Use of precautionary methods to prevent physical or mental illness. (206)
- Protective reflex.** Reflex which serves to protect the organism, such as withdrawal of a limb when it is injured. (487)
- Psychiatric social worker.** The holder of a master's degree in social work who works with psychiatrists, psychologists, and other mental health workers, especially in providing data about the social aspects of a client's problem; often practices limited psychotherapy. (209)
- Psychiatrist.** Holder of an M.D. degree who specializes in the treatment of mental illnesses. (209)
- Psychoanalysis.** School of psychology, originated by Freud, which emphasizes the study of unconscious mental processes; also, a method of psychotherapy which seeks to bring unconscious desires into consciousness and make it possible to resolve conflicts which usually date back to early childhood experiences. (12)
- Psychoanalyst.** Therapist who uses the special system

- of theory and practice called psychoanalysis, required by organized psychoanalysts, though not by law, to have an M.D. degree. (209)
- Psychobiology.** Eclectic approach to therapy developed by Adolph Meyer; aims at an understanding of all factors—biological, psychological, and social—involved in a disorder. (229)
- Psychodrama.** Form of psychotherapy in which the patient acts out life situations that are related to his difficulties. (223-224)
- Psychograph.** Chart showing an individual's standing on a group of objectively measured or rated traits; the traits are listed on one axis of the chart and the centiles or other values for each trait are marked at the appropriate points along the other axis, the points being connected so as to show a profile of the individual's traits. (82-83)
- Psychological and social drives.** Drives resulting from such needs as those for social approval, self-esteem, economic security, and greater knowledge; probably acquired as the result of experience. (124)
- Psychological primaries.** Red, yellow, green, and blue, so called because they appear psychologically irreducible. (247)
- Psychological selectivity.** Process of selecting and consciously reacting to only those stimuli, from among the vast number within range, which are related to our present needs and interests; attention. (266)
- Psychological test.** Carefully planned situation in which the individual's responses can be described by a numerical value or score. (67)
- Psychological zero point.** Point at which neither warmth-sensitive spots nor cold-sensitive spots are stimulated; point of indifference, usually about 90 degrees Fahrenheit. (259)
- Psychology.** The field of study which seeks by scientific methods to describe, understand, predict, and control the behavior of living organisms. (11)
- Psychometrist.** Specialist in the administration, scoring, and interpretation of standardized psychological tests. (512)
- Psychophysics.** Exact science of the functional relations between body and mind, concerned chiefly with determining the relationships between the physical qualities of stimuli and the psychological sensations they produce; the direct forerunner of experimental psychology. (11)
- Psychosis.** Severe mental disorder in which the patient usually loses contact with reality. (184)
- Psychosomatic disorder.** Physical symptoms, often including actual tissue damage, that may result from the continued mobilization of the body during a sustained emotional disturbance. (155)
- Psychosomatic medicine.** A medical specialty devoted to the diagnosis and treatment of bodily ailments which result at least partially from sustained emotional tensions. (154)
- Psychosurgery.** Brain surgery used in the treatment of severe psychoses that have resisted all other known forms of treatment. (222)
- Psychotherapy.** A general term to describe treatment of personality and behavior disorders by psychological methods. (208)
- Puberty.** Stage of physical development when reproduction first becomes possible. (49)
- Pupil.** Opening in the iris of the eye through which light enters the eye. (237)
- Purkinje effect.** Phenomenon experienced at nightfall, when the hues at the violet or short-wave end of the spectrum appear brighter than other colors; caused by the fact that during dark adaptation the eye loses sensitivity first to red and yellow and later to blue and green. (238)
- Pursuit movements.** Gliding movements made by the eye in following moving objects. (239)
- Pursuit rotor.** Apparatus used in studies of motor learning; subject must keep the point of a hinged stylus on a small brass target on a revolving turntable. (304)
- Pyknic type.** The short, plump body type of Kretschmer's theory; expected to have a cyclothymic temperament, characterized by fluctuations between gay and depressed moods. (7)
- Qualitative classification.** Classification of items into classes or categories which are not related to each other in a mathematical or quantitative manner. (18)
- Qualitative research.** Motivational research in advertising. (443)
- Quantitative classification.** Classification of items into categories on the basis of some characteristic which can be measured on a mathematical scale. (18)
- Quantitative research.** "Nose-counting" type of advertising research which collects quantitative facts about the customers or potential customers for the product. (442)
- Race.** A classification of human beings as Mongoloid, Negroid, or Caucasian on the basis of such physical characteristics as skin color, cephalic index, eye form and color, etc.; often applied incorrectly to religious and nationality groups. (414-416). See *Ethnic group*.
- Radial acceleration ("g").** Factor causing change in the amount of blood going to the brain when, as in an airplane, there is a sudden change in direction. Amount of blood may increase or decrease, depending on whether the head is toward the center or outside of the curve; decreases tend to slow reaction time. (294)
- Radial motion.** Movement directly toward or away from the observer; perceived when the size of the retinal image continuously changes. (284)
- Rating scale.** Device for recording the rater's judgment of himself or others on defined traits. On relative rating scales, such as the order-of-merit scale, the rater ranks the subjects in order from highest to lowest on the trait in question. On absolute rating scales, the judge assigns an absolute value or score to the trait being rated. (74)
- Rationalization.** Defense mechanism by which seemingly logical explanations are devised to explain and justify behavior which might otherwise result in loss of social approval and self-esteem; a form of intellectualization. (183)
- Rauwolfia.** Drug used to make mental patients calmer and more accessible to psychotherapy; its active ingredient is reserpine. (220)
- Raw score.** Numerical score obtained on a test; cannot be compared with scores from other tests until all scores have been converted into common terms. (84)
- Reaction formation.** Defense mechanism in which the individual's conscious attitudes and overt behavior patterns are the opposite of his unconscious wishes, which have been repressed. (177-178)

- Reaction time.** Time that elapses between a stimulus and an individual's response to it. (291)
- Realistic thinking.** Thinking which is determined primarily by the requirements of the external situation, tends to be productive or to aid in problem solving. (358)
- Rearrangement.** Method of measuring retention in which subject arranges a scrambled list of items in the order in which he originally learned them. (315)
- Recall.** Most widely used method of measuring retention, with a bare minimum of cues, subject must reproduce a response which he has learned earlier. (314)
- Receiver.** The part of a communication system which decodes the signal. (376)
- Receptor processes.** Sensory processes involved in perception. (271)
- Receptors.** Organs of adjustment which receive stimuli and set up nerve impulses in the sensory nerve fibers. (16)
- Reciprocal innervation.** Process by which the excitation of one of an antagonistic pair of muscles is accompanied by the inhibition of the motor neurons supplying the other. (487)
- Recognition.** Method of measuring retention in which subject identifies previously learned items from among a list in which the learned items are interspersed with others. (314)
- Redirection.** See *Desensitization*.
- Referred pain.** Pain experienced at a different location from the area actually hurt. (258)
- Reflex.** Specific, automatic response involving only a small part of the body, such as the knee jerk or the grasping reflex of an infant. (40)
- Reflex arc.** See *Sensory-motor arc*.
- Regression.** Defense mechanism in which the individual seeks to return to an earlier, more secure period of his life. (175-176)
- Reinforcement.** In classical conditioning, the process of following the conditioned stimulus by the unconditioned stimulus; in instrumental conditioning, the rewarding of the learner for adequate responses. (299)
- Relearning.** Most sensitive method of measuring retention; the subject relearns the original task under the original conditions, the difference in amount of needed practice providing the measure of retention. (315)
- Reliability.** The degree to which people earn the same rank or score each time they take the same test or an equivalent but different form of it; one criterion of a good measuring instrument. (67)
- Reminiscence.** Ability to remember a larger amount of incompletely mastered material at a later date than was recalled immediately after the cessation of practice. (340-341)
- Repression.** Defense mechanism in which painful or guilt-producing thoughts, feelings, or memories are excluded from conscious awareness; such repressed memories may remain active at an unconscious level, resulting in bizarre behavior. (177)
- Reserpine.** Tranquilizing drug employed in the treatment of mental patients. (220-221)
- Resistances.** In psychoanalysis, inability or unwillingness to discuss certain ideas, desires, or experiences during free association. (214)
- Resonance theory.** A place theory developed by Helmholtz, who maintained that the basilar membrane consisted of a series of resonating fibers that were tuned to different frequencies, with each vibrating membrane exciting a receptor cell located at the same place; main difficulty of the theory, which is no longer accepted, is that the basilar membrane does not consist of separate fibers. (254)
- Reticular formation.** Neural structure extending from the medulla through the pons and midbrain; important in arousing and alerting the organism and also in controlling attention and perceptual discrimination. (559-560)
- Retina.** Sensitive inner layer of the eye, containing the light-sensitive rods and cones. (236)
- Retinal disparity.** The slight difference in the retinal image which the two eyes get from the same object; helps make possible depth perception. (282)
- Retroactive facilitation and inhibition.** The facilitation or inhibition of remembering caused by the nature of activity which intervenes between learning and recall. (342)
- Rhinencephalon.** Area consisting of primitive cortex and complicated subcortical structures which have both olfactory and emotional centers; located between the cerebral cortex and the midbrain. (503)
- Rods.** Receptor cells of the retina capable of producing sensations of white, gray, and black but not of colors; effective in both day and night vision. (237)
- Rorschach Test.** A projective test requiring the subject to tell what he sees in a series of inkblots, some of which are in color. (78)
- Rote learning.** Verbatim learning, without regard for meaning. (332)
- S-shaped curve.** Graphic presentation of a learning experience, usually indicating that the entire learning process has been studied; indicates a period of increasing returns from practice during early trials, a period during which the rate of improvement remains constant, and finally a period of decreasing improvement. (312)
- Sacculi.** Saclike chamber in the vestibule at the base of the semicircular canals of the ear; contains receptors which respond to the static force of gravity and to straight-line motion. (260)
- Sampling.** The selection of a sample of individuals or measurements from the total group which is to be studied; errors of sampling, i.e., selection of a sample that is unrepresentative of the whole, may invalidate the results of the study. (90-91)
- Saturation.** Quality of color determined by the complexity of the light waves emanating from an object. More complex waves decrease the saturation, resulting in a grayish color. (246)
- Scapegoating.** Process of displacing aggression onto some object or person not the cause of the frustration. (178)
- Schemata.** Persistent, deep-rooted, well organized classifications of situations and of kinds of behavior appropriate in those situations; influence our perceptions. (272)
- Schizophrenia.** Psychosis characterized by emotional blunting and distortion, withdrawal from reality, and disturbed thought processes. (199)
- Schizothymic.** Temperament pattern characterized by sensitivity, eccentricity, and reserve; in Kretschmer's body-type theory, associated with the leptosoma. (7)
- Sclera.** Outer protective layer of the eye; sclerotic coat. (236)

- Score.** Mathematical quantity expressing the results of a measurement. (18)
- Self.** The total individual, regarded as aware of his continuing identity. (32)
- Self-concept.** The individual's awareness of his continuing identity as a person. The self-concept develops gradually from an infant's discovery of the parts of his own body and comes to include all an individual's thoughts, feelings, attitudes, values, and aspirations. (58-59)
- Self-inventory.** Instrument for measuring personality traits by having the individual give information about himself; its validity is limited by the subject's lack of self-understanding and by his desire to make himself appear better than he really is. (76-77)
- Semantics.** Technique for sharpening the accuracy of thinking; emphasizes the need for operational definitions of words and the importance of avoiding the tendency to regard words as things rather than as mere names for concepts. (367)
- Semicircular canals.** Tubes of the inner ear in which the receptors for passive movement are located. (280)
- Sensory aphasia.** Inability to recognize spoken words, often called "word deafness." (496)
- Sensory-motor arc.** Functional unit of the nervous system; typically contains a receptor neuron, one or more correlation neurons within the spinal cord or brain, and an effector neuron; also called a reflex arc. (479, 484-485)
- Sensory neuron.** See *Afferent neuron*.
- Septal region.** Area of the brain along the dividing line between the two hemispheres, just below the front bend of the corpus callosum; active in rage and savageness. (503)
- Serial learning.** Verbatim learning in which the subject is shown a series of words or syllables one at a time and on successive showings must learn to anticipate the item that is coming next in the series. (303)
- Servomechanism.** Machine which is intrinsically purposeful or goal-seeking; for example, a torpedo with a built-in target-seeking device. (569)
- Set.** Readiness to respond in a particular way to some stimulus situation for which there are a variety of possible responses. (267)
- Shock therapy.** Method of treating severe mental disturbances by inducing convulsions which are followed by a state of coma; may be induced by insulin, metrazol, or electricity. (218)
- Sibling.** A brother or sister. (85)
- Sigma.** See *Standard deviation*. (87)
- Sigma.** Smallest unit in the measurement of reaction time; one-thousandth of a second. (292)
- Simultaneous hue contrast.** Apparent change in hue of gray to take on the complementary hue of the color seen next to the gray. (248)
- Situational test.** Test which presents a miniature life situation and measures performance under conditions which require traits to be organized into functional units. (68)
- Skewed curve.** Distribution curve in which the majority of cases cluster about a point below or above the middle; often indicates that a poor sample was used in the study. (85)
- Skinner box.** Soundproof box containing a small lever which the animal must push in order to cause a food pellet to drop into a food tray; used in experiments on instrumental conditioning. (301)
- Sleeper effect.** An increase in the effect of a propaganda communication over a period of time, contrary to the normal expectation that the message would be forgotten; occurs when source of propaganda is discounted, since the discounting factor tends to be forgotten more rapidly than the message itself. (436)
- Snellen test.** Block-letter chart used to test visual acuity. (242)
- Social drives.** See *Psychological and social drives*.
- Social feedback.** The exchange of error-reducing information in group situations. (377)
- Social stimulus value.** The effect an individual has on others; includes his external appearance and his behavior toward others. (65)
- Sociology.** Study of the cultural conditions and social institutions which are evolved by people living in groups and which in turn influence the behavior of individuals belonging to those groups. (13)
- Sociometric choices.** Choices made by group members of those they like or would prefer for specified roles or activities; a technique used in studying intra-group relationships. (395)
- Somatotonia.** Personality type characterized by love of adventure and strenuous exercise, informal dress, and fortitude in bearing pain; in Sheldon's theory, associated with the mesomorph. (9)
- Somatotype theory.** Sheldon's classification of body types, called somatotypes, each of which can be identified with a corresponding personality type. (8)
- Somesthetic area.** Body-sensitivity area of the cerebral cortex, located just back of the fissure of Rolando. (491)
- Spacial summation.** See *Summation*.
- Spectograms.** Pictures of sound waves which permit objective analysis of speech sounds. (43)
- Speed test.** Test in which the score may represent either the amount of work done in a constant period of time or the amount of time needed to complete a constant amount of work. (68)
- Sperm.** Male gamete or germ cell. (32-33)
- Spinal reflex action.** Simple stimulus-response behavior not ordinarily involving centers in the brain; can be studied by separating the spinal cord from higher centers of correlation. (486)
- Spontaneous recovery.** The return of a conditioned response following experimental extinction, after an interval of no stimulation. (300)
- Stage of exhaustion.** See *General-adaptation-syndrome*.
- Stage of resistance.** See *General-adaptation-syndrome*.
- Standard deviation (sigma).** Most commonly used indicator of spread, representing a certain distance along the base line of a distribution curve; in a normal distribution 68 per cent of the cases fall within one standard deviation above or below the mean, 95 per cent within two, and almost 100 per cent within three. (87)
- Standard score.** Score obtained by finding the difference between the raw score and the mean and dividing that difference by the standard deviation; particularly useful in comparing scores on different tests. (87)
- Standardization.** Process of obtaining norms, or standards, for comparing individual scores on a test; obtained by administering the test under standard conditions with standard instructions to a large group of persons who are representative of the individuals for whom the test is intended. (67)

- Standardized application blank. Application blank in which the items have been chosen on the basis of their relationship to a criterion that is valuable in predicting success on the job. (458)
- Standardized interview. Interview in which predetermined questions are asked in a certain set order. (76)
- Static reaction. Control system in which the operator holds something in a fixed position, as in operating a lathe. (472)
- ✓ Statistical analysis. Technique of controlling variables mathematically when it would otherwise be impossible to hold them constant; also used in analyzing complex skills which involve several separate abilities operating together. (27)
- Stereotype. A preconceived notion, based upon prejudice rather than fact, as to the traits possessed by people of a given racial, national, or other group. (76)
- Stimulation method. Method of determining which parts of the brain are related to muscular activity by stimulating areas of the brain and observing which muscles move. (490)
- Stimulus (pl stimuli). An energy given off by a stimulus object which, if strong enough, excites a receptor. (16)
- Stimulus generalization. Spread of a conditioned response to other similar objects. (160)
- Stimulus objects. The parts of the environment that cause an individual to react at any particular moment, or that are capable of making him react. (16)
- Stimulus-response theory. See *Associationism*.
- Stirrup. The last of three hinged bones in the ear (the others being the hammer and anvil) which together transmit vibrations from the eardrum to the oval window. (254)
- Stress. Unpleasant emotional upheaval which the individual experiences in response to frustration. (172)
- Stressor. Anything injurious to the organism, either physically or psychologically. (157)
- Structural connections. Neural associations established by maturation and potentially capable of eliciting particular types of responses. (44)
- Structuralists. School of psychology which taught that psychology should study conscious experience, conceived as made up of elementary mental states directly observable through introspection. (11)
- Sublimation. The indirect expression of a need which cannot be satisfied directly, through acceptance of an alternate goal which provides a socially acceptable outlet of expression; usually refers specifically to indirect expressions of the sexual urge. (182)
- Subliminal. Below the threshold; too weak to produce a conscious response. (285)
- Substitution. Expression of frustrated impulses indirectly but with no change in the conscious quality of the desire; often involves socially unacceptable activities and guilt feelings. (182)
- Subthalamus. Subcortical center just beneath the thalamus which exerts control over the voluntary muscles of emotional expression. (503)
- Subtractive color mixture. The mixture of pigments, in which wave lengths are subtracted through a process of absorption. (247)
- Sulcus. See *Fissure*.
- Summation. Production of a response by a combination of stimuli that, singly, are too weak to produce a response. Temporal summation is accomplished through the repetition of a weak stimulus, spatial summation through the simultaneous stimulation of two or more adjacent points (487-488)
- ✓ Superego. In psychoanalytic theory, that part of the personality which guards the ideas of right and wrong learned as a child; in constant conflict with the id; corresponds to the "conscience." (213)
- Supordinate goals. Goals shared by different groups; cooperation in working toward these goals leads to a decrease in intergroup hostility. (395)
- Survey method. Technique by which an investigator obtains data from a large group by using written questionnaires or oral interviews. (25)
- Syllogism. Element of formal logic, consisting of two premises and a conclusion, which may be valid or invalid. (366)
- Symbol. An image, object, or activity that represents and can be substituted for something else, as, for example, words and numbers. (349)
- Symbolic rewards. Words or objects which cannot themselves satisfy biological drives but which come to be associated with primary rewards until they eventually acquire a reward value of their own. (187)
- Sympathetic division. Division of the autonomic nervous system which is active in emergency conditions of extreme cold, violent effort or exercise, and states of fear or rage. (481, 500)
- Synapse. Association, without direct contact, between the end brushes of one neuron and the dendrites of another. (485)
- Synesthesia. Translation of sensory experience from one sensory mode to another, as in seeing colors when sounds are heard. (350)
- T scores. Modified standard scores obtained by multiplying the standard score by 10 and adding 50, for the purpose of avoiding zero or negative scores. (88)
- Taraxacin. Substance obtained from the blood of schizophrenic individuals; capable of causing schizophrenic symptoms when injected into normal individuals. (197-198)
- Taste buds. Clusters of receptors located on the tongue and responding to the four elemental qualities of taste—sweet, sour, salt, and bitter. (262)
- Telephone theory. A frequency theory of hearing, according to which the basilar membrane plays the role of a telephone transmitter, relaying impulses of various frequencies to the brain; unacceptable because a single nerve fiber cannot respond to frequencies greater than 1000 cycles per second. (254-255)
- Temporal lobe. Portion of the cerebrum separated from the frontal and parietal lobes by the fissure of Sylvius and lying just beneath the temples. (486)
- Temporal summation. See *Summation*.
- Termination rate. Rate at which employees leave their employer through resignation or discharge. (452)
- Testicular androgens. Male sex hormones produced by the testes; the major hormones responsible for the development of masculine characteristics during adolescence. (49)
- Thalamus. Part of the old brain; responsible for sensations of pain and some diffuse, poorly localized sensations of pleasure or discomfort. (481)
- Thematic Apperception Test (TAT). Projective tech-

- nique consisting of a series of pictures, about each of which the subject is asked to make up a story. (80)
- Theory.** A logically organized set of principles propounded for the purpose of explaining a given group of phenomena. (19)
- Thinking.** The implicit manipulation, through the use of symbols, of ideas or objects not physically present to the senses. (349)
- Threshold.** Transitional point at which a stimulus becomes strong enough to produce a conscious response; linen. (235) See also *Difference threshold*.
- Throughput.** In cybernetics (as applied to man), activity within the nervous system which activates muscles to produce a response. (369)
- Thyroids.** Endocrine glands located in the neck which affect body metabolism, influence intelligence, and help control the rate of physical growth. (47-48)
- Timbre.** Quality of sound determined by the complexity of the sound wave, that is, by the number of overtones or partials which sound along with the fundamental tone. (251, 253)
- Trait.** Characteristic which can be observed or measured. (66)
- Transfer.** See *Negative transfer* and *Positive transfer*.
- Transfer and testimony.** Persuasive device by which a new object, idea, or personality is identified with something venerated and respected. (437)
- Transference.** Process by which a patient in psychoanalytic therapy attaches to the therapist feelings formerly held toward some person who figured in an emotional conflict, often a parent or lover. Feelings may be those of love and admiration (positive transference) or envy and hostility (negative transference), or they may be ambivalent. (215)
- Transitional cortex.** A band of cortex running from the midline side of the frontal lobe across its underside and onto the temporal lobe; stimulation in this area produces visceral responses and vocalizations which are interpreted as emotional responses. (502)
- Transmitter.** That part of a communication system which converts the information into energy. (378)
- Trial and error.** Attempts to solve a problem by trying out alternative possibilities and discarding those that prove to be unsatisfactory. (308)
- Umbilical cord.** Cord which attaches the fetus to the placenta; contains blood vessels through which the fetus receives oxygen and nutrients and disposes of wastes. (37)
- Unconditioned response.** Response made to an unconditioned stimulus; often an inborn reflex, as in the case of salivation in response to food. (299)
- Unconditioned stimulus.** Stimulus which elicits an unconditioned or natural response. (299)
- Unconscious mental processes.** Psychological processes or events which are below the level of consciousness (often as a result of repression) but which exert an important influence on the individual's behavior; first postulated by Freud. (12)
- Undoing.** Form of intellectualization in which the individual divests himself of painful feelings by making use of a cleansing ritual after doing something which causes him to feel guilty. (183)
- Utricule.** Saclike chamber in the vestibule at the base of the semicircular canals of the ear, containing receptors which respond to the static force of gravity and to straight-line motion; important to our sense of passive movement. (260)
- Validity.** Extent to which a measuring instrument actually measures what it was designed to measure (68)
- Variable.** See *Dependent variable*, *Independent variable*, and *Intervening variable*.
- Variance.** Standard deviation squared; helpful because it can be added or subtracted meaningfully, whereas the standard deviation cannot. (88)
- Ventromedial nucleus.** Area in the hypothalamus whose destruction causes savage behavior and takes the brakes off the animal's eating mechanism. (503)
- Virilism.** Accentuation of masculine characteristics caused by overactivity of the adrenal cortex. (48)
- Visceral nervous system.** See *Autonomic nervous system*.
- Visceratonia.** Personality type characterized by fondness for food, amiability, apprehension and insecurity, and conventionality; in Sheldon's theory, associated with the endomorph. (9)
- Visual acuity.** Sharpness of vision. (236)
- Visual-positioning movements.** Control system in which the individual gets visual information while he is operating the control, as in setting a watch (472)
- Vocational rehabilitation.** Process of helping people with permanent partial disabilities to prepare for and enter, or return to, productive employment. (514)
- Volley theory.** Auditory theory that nerve fibers operate in groups and that various fibers discharge their volleys of impulses at different times, making it possible for a bundle of fibers to reproduce high frequencies. Adequate for frequencies up to 5000, with a place theory being needed to explain higher frequencies. The combination is known as the place-volley theory. (255)
- Wave length.** Linear distance from a point on one light or sound wave to the corresponding point on the next wave. Wave lengths of light are the physical stimuli for sensations of hue; wave lengths of sound are the stimuli for sensations of pitch. (245)
- Weber's law.** Law stating that the difference threshold or just noticeable difference (j.n.d.) in perceived intensity occurs when the stimulus is increased by a certain constant proportion of itself. This law does not hold for extreme values. (236)
- Wernicke's center.** Area on cortex of temporal lobe below the auditory area, extending backward and curving up around the end of the fissure of Sylvius; its loss is associated with inability to understand spoken language. (494)
- Withdrawal reactions.** Defense mechanisms involving physical flight or psychological withdrawal from the frustrating situation. (174)
- Withdrawal reflex.** Simple, specific response by which the hand or any other part of the body is automatically withdrawn from a painful stimulus. (135)
- Young-Helmholtz theory.** Theory that the human eye contains three kinds of cones, each sensitive to one of the three primary colors of light. (245)
- Zeigarnik effect.** Tendency to remember uncompleted tasks better than completed ones; tends to be reversed for tasks performed under stress. (343)
- Zygote.** Cell formed by the union of the male and female gametes. (83)

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